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Pumping Station Economies.

In cities of less than 50,000 inhabitants the daily consumption of water is usually not sufficient to call for pumping engines of the most efficient size and type, nor, it would seem, to demand the employment of men of the highest class at the pumping station. It is an admitted fact that for many reasons plants for the supply of water and other public utilities are operated much more cheaply in this country under private than under municipal ownership. And as, with the exception of San Francisco, no American city of over 300,000 inhabitants is supplied with water by a private corporation, it follows that the lowest pumping station costs will generally be found in cities of between 50,000 and 300,000 people, and where the water-works are under private ownership.

Of all the conditions which affect the cost of pumping water, the head against which the water has to be pumped is almost the only one which cannot usually be altered, to some extent at least, by good or bad management on the part of those in charge of the pumping station. Wide variations in cost per million foot-gallons may, therefore, be expected. For instance, a prominent engineer has recently discovered, after a careful investigation made in one of our larger cities, that the station costs per horse-power in water pumped at the municipally owned pumping stations averaged two and two-thirds times as much as the station costs per horse-power of electrical output at the privately owned light and power plants in the same city.

The field of action of the pumping engineer may be said to begin at the coal pile and end with the water delivered into the force-main. Between these two limits every feature of the construction and operation of the plant has some bearing, more or less important, on the results obtained per dollar of costs.

An accurate knowledge of all the working conditions is the first requisite to intelligent effort to keep down expenses, and the daily pumping station report should, therefore, include all data which are in any way pertinent. This report should be studied as carefully by the engineer in charge of the station as the compass and chart are studied by the navigating officer of the ship. Space will permit the suggestion of only a very few of the many ways in which the engineer's skill and judgment may be profitably employed.

Much has been written on the important subject of firing. It is for the engineer to determine by careful test in actual practice which method of firing will give best results with each class of coal that he buys. There is usually a wide difference in the prices of the several kinds and sizes of coal in the same market, and an important saving may often be made by the selection, after a study of the pumping report, of the size and kind of coal which, at the market price, will pump more water per dollar of cost. For example, an engineer who had recently taken charge of a certain pumping station found that his predecessor had been burning lump coal and run of mine, costing from $1.10 to $1.20 per ton. Tests of sample cars of various coals showed that there was to be had in the market at 65 cents per ton a grade of nut, pea and slack which gave results within 10 per cent. as good as the best lump or run of mine available. The change to this coal resulted in a decrease of one-third in the next year's coal bill, notwithstanding an increase of 20 per cent. in water pumped.

The feed-water problem always merits careful attention. While no fixed rule can be laid down for all conditions, the best modern practice, where the available water is hard, leans to the use of as much condensed steam as possible, combined with the removal of as much of the oil as can be taken out by oil separators or other devices. Excellent results have in some places been obtained by the use of slow sand filtration, without coagulant, to remove oil from the condensed steam.

The less oil used in the valves and cylinders, the less there is to be afterward removed from the condensed steam, so that it is usually good policy to buy the very best cylinder oil and to use as little of it as may be consistent with effective lubrication. The steam cylinders, especially of vertical engines, need little or no lubrication, and the cylinder oil feed should be confined as much as possible to the working parts of the valves.

Rubber pump valves should only be purchased after actual test in service of sample valves from different makers. Few commercial products are so uncertain as rubber. A very slight difference in mixture or tempering may greatly change the product, and the manufacturers themselves often find it hard to get the same results twice in succession. Under these circumstances an expensive valve often gives poorer results than one that costs much less.

A glance around the pumping station will give a pretty good line on the efficiency of its engineer. If leaks of steam or water are allowed to run unchecked, or the lagging of steam pipes to remain in bad order, the observing visitor always carries away a bad impression. Great care should be taken to prevent sudden variations in temperature of engine room and boiler room. In cold weather one failure to keep the building properly heated may result in scores of expensive leaks in engines, boilers and pipe lines, and may even cripple the plant at a critical time.

Discipline among the pumping station crew is essential to good results, and the easiest way to maintain discipline is to see that the men are always busy. No man should be allowed to loaf while on duty. At the same time no pains should be spared to teach each man the best way to perform his allotted task, and to stimulate his interest in it by letting him see the improvement in results due to his own improvement in skill. Every possible opportunity should be offered for the material advancement of faithful and zealous workers. In these and countless other ways the engineer may effect economies which, when they appear in the records, will make good reading for himself and his employers.

Standard Specifications in Civil Engineering.

So much attention is now being paid to the standardization of specifications for both materials and designs for engineering works that there may be some danger of overdoing the thing. In so far as standardization helps to raise the quality or lower the cost of good engineering work it is useful, but when it stunts the exercise of critical judgment and turns construction into mere thoughtless copying it is injurious to the true good of the art. It was not so long ago that specifications for steel rails, structural material, cement, car wheels and other materials were as varied as the colors of Joseph's coat, and it has been a good step to reduce all these variations to a standard. This enables the purchaser to secure better material at a lower cost. On the other hand, if this elimination of numerous minute and needless differences and the obsolete or contradictory requirements due to copying and garbling antiquated clauses of ripe old age tends to prevent the use of usual grades of materials for special needs, it deserves to be strongly opposed. Special grades of materials will always be required, for the conditions of engineering construction can themselves never be standardized, and, consequently, there must always be exceptions to the usual conditions, for which exceptional materials and designs will be needed. In such cases, however, it is important to bear in mind that an extra expense will generally be attached to the adoption of all special requirements.

The danger of standardization is not so much in the specifications for materials as in the designs and specifications for their use. Every large engineering or architectural office is compelled to prepare standard designs of details occurring in its practice and for the grades of workmanship commonly called for. On the other hand, the man who goes to such an office for designs for a mill building, for example, and, almost while he waits, is handed plans and specifications prepared by copying off a lot of standards, may be excused if he thinks that he has by mistake entered a shoe-shop instead of an engineering office. Such ready-made designing is a good thing within reasonable limits, for it ensures rapid work and well-digested detailing, since the standards usually have received a great deal of careful thought. On the other hand, the very fact that it is so easy to get out plans in this way is a temptation to hurry over the careful consideration of local conditions and their effect on details.

In the matter of railway construction this effect of the standardization of details has already attracted the attention of a good many officials, and they have been compelled to point out the fact that an engineering standard, so far as it refers to design of structures, is not something which must be considered inviolable, but is rather a system which it is advisable to approach only so far as it is good practice to do so. In other words, these standards are simply an expression of opinion by competent engineers of the designs best suited for general conditions. In considering them it is important to bear in mind that good practice may require a departure from many of their requirements, and when this is the case there should be no hesitation in adopting such special plans and specifications as are suited for the local conditions.

In one sense civil engineering is likely to be less attractive to young engineers than electrical and mining engineering because it is becoming so rapidly standardized in details. There is not the same opportunity for individuality. This situation is one of some danger to progress, because standardization means a fixing of practice and a checking of individual effort. It tends to conceal the fact that the standard of to-day was the innovation of yesterday, and if it does not become obsolete to-morrow there has been no progress worth mentioning.

Tests of Riveted Joints.

Although riveted joints are among the oldest of modern structural details, there is much yet to be learned about them. The primary elements of their computations have been known for many years, both in theory and by the results of tests of many full-size joints. The reports of tests by the Emery machine at the U. S. Arsenal at Watertown, Mass., abound in valuable information of that kind, and there are a number of other sources, some foreign, productive of much similar data. All these tests, however, have been made on joints of comparatively simple character, such as ordinary lap or butt joints, and with few variations of these elementary types. The greatest range in these tested joints has included little else than chain or zigzag riveting, punched or reamed holes, with a few cases only exhibiting a grouping of holes to indicate what the greatest net section may be in some cases of staggered joints.

All this elementary information concerning riveted joints is highly valuable, and its importance should not be underestimated. At the same time there are many special adaptations of joints constantly employed in steel structural practice about which little of a quantitative or exact character is known. This hiatus can be filled only by extended testing of full-size joints, and as such experimental work is expensive, exceedingly little of it has been done.

In view of such a condition, it is gratifying to find in Bulletin No. 62 of the American Railway Engineering and Maintenance of Way Association the report of its Committee on Iron and Steel Structures on tests of riveted joints. These tests of full-size riveted joints consist of seventeen groups of five each, fourteen of butt joints and three of simple lap joints with one, two and three rivets, respectively. The butt joints in no case had more than three longitudinal rows of rivets, and most of them, like the lap joints, but one. So far as the simple lap and butt joints, as such, are concerned, obviously nothing particularly new was developed, but marked value lies in the results found by testing these steel joints with special features of design, consisting of filler plates inserted under the covers, all the filler plates being severed at the joint, so that the outside or cover plates only carried the stress across the joints. The unusual value of these tests arises from the fact that just such a feature is employed in many joints of almost every riveted bridge structure and in many buildings.

Any condition of a joint which lengthens the shaft of a rivet, and so makes the transference of stress or load from one side of the joint to the other less direct, will certainly decrease the carrying power of that rivet and consequently the efficiency of the joint. It is of the utmost consequence in such a case to know with as much accuracy as possible what the decrease in efficiency is and what measures may be taken to make the joint as effective as if no filler plates were used.

Again, whatever may be the care exercised in riveting and however effective the riveting machine may be, it is difficult to make the upset rivet fill the entire hole so as to secure bearing contact between the shaft of the rivet and the wall of the hole, and that difficulty increases rapidly with the number of plates pierced. It is practically certain, therefore, that almost any riveted joint will exhibit a set or slip before all the rivets get their complete bearing contact necessary to develop the full resistance of the joint. This slip may effect the length of a structural member sufficiently to impair its fitness to take its computed load. The tests of this committee were made with a view to investigating the amount and character of this slip, and the results of their investigations are recorded in their report. The committee calls that point at which the aggregate shearing stress in the rivets is equal to the frictional resistance between the plates its "yield point." This point exhibits the first permanent deformation of the joint, after which the greatest resistance of the joint is developed by an increasing contact between the rivets and the walls of their holes. This yield point may be found with the shearing stress in the rivets no higher than 3,000 lb. or 4,000 lb. per square inch, or even lower.

The committee's work covered also the effect of making the filler plates longer than the outside covers, so as to insert rivets through them beyond the limits of the latter. It was found when the number of these excess rivets was not less than one-third of the number required, if no filler plates existed, that the prejudicial effect of the fillers was entirely cured. These results are distinct advances in the knowledge of riveted joints and give to the tests corresponding importance and value.

Every advanced step of this character accentuates the lack of exact information as to other features of riveted joints and makes it all the more desirable to extend experimental work so as to secure the lacking data, and this is particularly true in respect to the real net section in many riveted joints. If chain riveting is used, with every transverse row of rivets at right angles to the axis of the piece, there is no doubt as to the actual net section remaining after the rivet holes are punched. If, on the other hand, staggered riveting is employed, especially with a triangular group of holes on either side of the joint, there are no experiments in existence which indicate what may properly be taken as the net section. The pitch of the transverse rows of holes materially affects the true net section which, according to the arrangement of the holes, may be equal to any value between the gross section less one hole and the gross section less all the holes of one transverse row. A series of tests sufficient in number and properly laid out to supply this information would produce results of great value in the design of many riveted joints.

The actual distribution of stress in the simplest riveted joint is practically unknown, although some of the elementary conditions may be stated in a general way. This observation is applicable with much force to joints stressed within the elastic limit of the metal. The features of failure of a joint tested to destruction give direct hints at least of the kinds of stresses in the failed parts, but there is a special need of such carefully conducted investigations as will show the kinds and distribution of stresses in the various parts of riveted joints subjected to loads well within the elastic limits, so as to represent the conditions of ordinary duty.

The Classification of Excavation.

At this season of the year, when so much construction is in progress, attention may profitably be directed to a recent decision of the Missouri Supreme Court concerning the classification of excavation. The work was done by Thomas McGregor for the J. A. Ware Construction Co., a subcontractor of the Laclede Construction Co., on some grading for the St. Louis, Peoria & Northern R. R. McGregor's prices were 9 cents for earth excavation and 30 cents for loose rock; he was paid at the rate of 9 cents for 22,436 cu. yd. of excavation, for which he demanded the 30-cent rate. The specifications of the Laclede Construction Co. defined materials as follows: "The materials found in the excavation will be classed as solid rock, loose rock and earth, the chief engineer being in every case the final judge as to the class to which any material belongs. Solid rock will include all loose boulders containing one cubic yard or more, and all hard rock in compact strata or ledges exceeding 6 in. in thickness which, in the judgment of the engineer, cannot be loosened except by blasting. Loose rock will include all loose boulders containing more than three cubic feet and less than one cubic yard, and all material requiring the use of pick and bar, or which cannot be plowed with a strong 10-in. grading plow, well handled, drawn by a good six-horse team. Earth will include all material of whatever kind which does not clearly belong to one or the other of the foregoing classes."

The facts in the case, according to the Supreme Court, see 87 S. W. Rep. 981, are that McGregor notified the resident engineer during the progress of the work that he had found very hard earth, which could not be plowed with a 10-in. plow and six horses, but required eight horses. In the testimony of Mr. Robert Moore, chief engineer, the material was designated as a wet clay which was extremely difficult, if not impossible, to classify. It was, he said, a wet, rather leathery sort of substance very difficult and expensive to handle, but amounted to only 2,400 cu. yd. The material was classified as earth and paid for as such. McGregor deposited the check, kept the proceeds, but refused to sign a receipt for final payment, merely crediting the company with the amount and bringing suit for the difference between the sum received and the total at the rate of 30 cents.

It is important to note that the resident and chief engineers both agreed that the 2,400 yd. of troublesome material was more difficult to handle than earth and Mr. Moore testified that he might have classified it as loose rock, under the specifications, had he not understood that the contractor was willing to call it earth provided he was given a $600 bonus. As a matter of fact the contractor refused this bonus. "The utmost that can be fairly said," the court stated, "of the testimony of the chief engineer is that it leaves the matter in an unsatisfactory condition, and shows that he felt that, while the plaintiff's claim that the material was properly loose rock was not tenable, still it was something more than mere earth excavation, and, therefore, being outside the specifications, he made an equitable allowance of $600 therefor." The court decides that because McGregor accepted and kept the check for final payment at the 9-cent rate, instead of returning it and suing for payment at the 30-cent rate he claimed, he was estopped from suing later for the latter rate. The court also holds that, under the specifications, the engineer's decision concerning classification was final, subject only to review by the courts.

Attention is called to this case because it points out definitely two dangers to which such contracts are exposed; first, faulty use of names of common materials to designate classes of work, and, second, neglect to take proper legal steps in contesting such disputes. There can be little question that had McGregor stuck to the letter of his specifications and refused to accept the check sent him for final payment at the 9-cent rate, he could have collected at least part of his claim. The case was muddled by using the terms "rock, loose rock and earth" instead of "classes A, B and C." The latter designations, which are gradually coming into use on all kinds of contracts, are infinitely better than the old terms employed in the specifications for the work involved in this litigation. Under those specifications the contractor was entitled to a 30-cent rate if he could not plow the material with six horses. It made no difference what the material was, for the classification depended on the plowing. But so badly was the classification confused by the use of the term "loose rock" for material that might contain no rock whatever, such as indurated clay, that the whole thing became tangled up. It was doubtless true that it did not cost 30 cents to excavate this clay, and if the contractor were paid at that rate he would make a large profit. Nevertheless, there was no grade provided for in the specifications between the 9-cent and 30-cent rate, and the contractor was entitled to profit by this fact.

So much confusion has been caused by these older methods of excavation classification that the subject might be advantageously discussed by some society where both engineers and contractors have equal freedom of speech. Classification is so important and so needlessly miscalled in the old specifications that a thorough discussion and simplification of the subject is absolutely necessary.

Notes and Comments.

THE HEILMANN LOCOMOTIVE, which attracted so much attention in France some years ago, may have a British successor, for Mr. Hugh Reid, managing director of the North British Locomotive Co., has patented an engine having multiphase motors and a Parsons turbo-generator with an air condenser, like those used on some Soudan Ry. locomotives. The condenser consists of tubes in a casing surrounding the machinery, the air being forced over the tubes by louvres on the casing, and then passing into the furnace. A fan is used for draught when the natural air flow is insufficient, and the condensed steam is used for boiler feed.

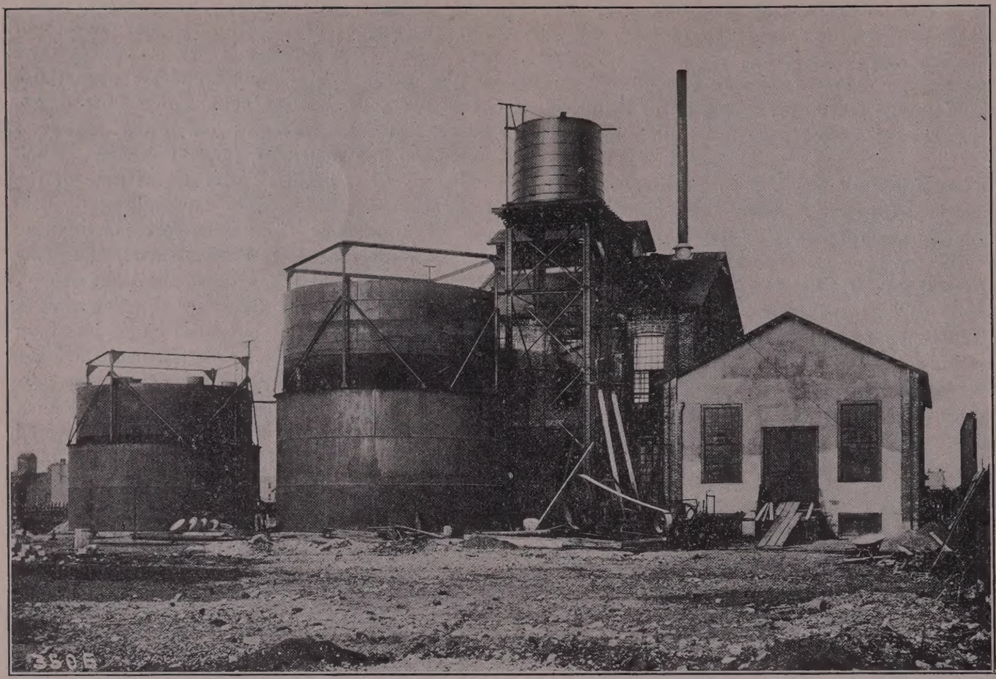
ELECTRIC HEATING is steadily growing in favor and there are a number of stations in the country which derive considerable revenue from this source. It will be recalled that about a dozen years ago it was demonstrated by some editors, to their own satisfaction, that electric car heating was terribly wasteful, yet it has since then been introduced very extensively from the Atlantic to the Pacific. In the same way heating small tools and cooking utensils will doubtless be proved by these pseudo-authorities to be impracticable, and the complete success of the innovations will thereby be assured. At the present time the greatest obstacle to the growth of the practice is probably the high cost of the apparatus, which can be greatly reduced and still give a good profit. Under present conditions, with the many household, shop and office conveniences available, the electric heater is more attractive, convenient and safe than any other, except for long-continued service, and can be operated cheaply enough to furnish an additional reason for taking on or maintaining electric service from a central station.

THE ADDITION OF SLAG to Portland cement is advised by Messrs. Seger and Cramer, as the result of experiments they describe in "Stahl und Eisen" for June 15. The addition of 25 per cent. of finely ground blast furnace slag to cement was found to increase considerably the tensile and compressive strength of the latter, both in neat and 1 : 3 mortar specimens. This fact had been previously pointed out by Tetmajer and Michaelis in Europe, and Mr. L. C. Sabin, in his invaluable "Cement and Concrete," refers to experiments by Mr. J. A. Shinn pointing in the same direction. He also gives some tests of his own that show an increased strength in mortars by the addition of 25 per cent. of pulverized clay and brick to cement, but it may be doubted whether he would advise such an addition to be made in actual work. This subject of the effect of slag will doubtless be brought up from time to time until it is settled by careful investigation, and experiments of this nature might advantageously be conducted as thesis work in some of our technical schools.

THE HARLEM RIVER TUNNEL, on the Interborough Rapid Transit Company's subway division, has been formally opened. This section of the work has been so fully described in The Engineering Record that it is unnecessary to more than mention the unique nature of the work in this place. Half of the tunnel was built at a time, in order not to close the river to navigation. The site of each half was dredged and piled, and the piles capped to receive a platform stiffened by trusses. Sheeting was then driven around this platform and in this way a water-tight shield was made under which the river-bed was excavated and the tunnel built, air pressure being used. In building the second half, the upper portion of the tunnel, which has a double-tube section with cast-iron lining, and concrete backing, was made on barges and sunk on the piles, like the temporary timber roof used on the first half of the work. This had sheeting driven around the edges and served as a shield under which the excavation and construction for the lower part of the tunnel were carried on. This method of working was devised by Mr. McBean, of McMullen & McBean, contractors for the tunnel.

THE RUNNING OF ELECTRIC TRAINS over the Rockaway Beach division of the Long Island R. R. is the fourth case of the electrification of steam roads in New York City. The first case, that of the New York & Harlem R. R. from the City Hall to Harlem, was reached by so many transitions that few people recall that the property is part of a system organized in 1831 and extending 127 miles north of the Grand Central Station. The second case is that of several steam-operated lines running to Coney Island which were taken over and electrified by the Brooklyn Rapid Transit interests. A third case is some of the lines on Staten Island. The interest in the changes on the Long Island R. R., however, is in no way diminished by what has been done elsewhere in the city, because they are distinctively a change in motive power rather than a consolidation with street railway lines. Not many years ago the possibility of such changes was frequently ridiculed as impracticable by railway journals. Today they are accomplished facts, and they show how important it is to be slow in underestimating the utility of electricity. Of course the system employed is very different from that suggested in 1893 and 1894. The power station, with its 5,500-kw. Westinghouse-Parsons turbo-generators and its double tier of Babcock & Wilcox boilers, is of a type possessing many advantages over those of earlier days, and the system of electric distribution has been developed and tested until it is no longer the distrusted innovation that seemed ludicrous to railroad officials at the time of the Columbian Exposition. The car equipments, also, are far in advance of anything foreseen in those days. With the New York Central, the New York, New Haven & Hartford, the Long Island, the Pennsylvania, the Delaware, Lackawanna & Western and the Erie companies either installing or getting ready to install electrical equipment for their suburban train service it hardly seems possible that little more than ten years ago any such change was generally ridiculed as the fevered dream of the electrical monomaniac or the tactless talk of electric salesmen.

THE IMPORTANCE OF WATERPROOFING was well shown at the recent meeting of the American Society for Testing Materials, when a special committee was appointed to study the subject, at the suggestion of Mr. A. W. Dow, inspector of asphalt and cement of the District of Columbia. Dr. Charles B. Dudley recommended taking this action in some forceful remarks on the lack of definite knowledge among engineers concerning the subject. He spoke of the difficulties of his recent investigations in connection with the preparation of specifications for waterproofing the Pennsylvania R. R. tunnels in New York. These call for a ½-in. troweled coat of 1 :1 Portland cement mortar on the concrete walls. This will be covered with seven layers of coal tar pitch and six layers of Hydrex felt or equally satisfactory material, laid alternately. This is protected in turn by more concrete, containing ducts. The brick tunnel roofs will be covered with two triple layers of felt and seven of pitch. The brickwork is to be mopped with pitch of a softer quality than that used on the walls, on which a triple layer of felt and pitch will be placed. This will be covered with a second coat of the soft pitch and the second triple layer of felt will then be put in place. By using the triple layers of felt and pitch the work of installing the waterproofing is made much easier than placing single alternate layers of pitch and felt in the manner employed on the walls. Finally another coat of pitch will be spread over the felt and covered with a course of brick laid on a ½-in. bed of 1 :1 Portland cement mortar. These requirements indicate the two-fold nature of the waterproofing problem. The American Society for Testing Materials will confine itself simply to the materials employed. The engineer, however, has to apply these materials, which is often the most difficult part of the work, as explained recently in the "Cement Age" by Mr. Edward W. De Knight. For example, when the First Avenue tunnel in Washington was undertaken by the Pennsylvania R. R., the matter of waterproofing had received little attention. It was finally determined to waterproof the roof, using Hydrex felt and compound substantially as described above. To do this, however, it was necessary to modify completely the system of tunneling and adopt that shown in The Engineering Record of May 20 and June 3 of this year. This gave room enough to apply the waterproofing and necessitated an amount of excavation considerably larger than would be necessary for unprotected arch masonry. The importance of the subject is not confined to tunnels, moreover, for city bridges present a large field for successful waterproofing; in fact, it is safe to say that the work of the committee of the American Society for Testing Materials will have marked results in engineering practice.



View of Plant during Construction, Engine House at Right

THE GAS POWER AND HEATING PLANT OF THE ATHA TOOL CO.

By J. R. Bibbins.

It seldom occurs in modern industrial work that power is obtained for nothing, but how nearly this may be approached is well illustrated in the recently completed power plant of the Atha Tool Co., Newark, N. J. The plant is comparatively small, but has been very creditably designed and operated, no legitimate expense being spared to insure permanent efficiency. It furnishes an excellent illustration of a type of plant which is becoming more and more popular in the United States, where metallurgical operations and power production may with advantage be carried on simultaneously, and it furnishes an instructive lesson in the economies in operating costs which the advent of the gas engine has made possible.

The plant in question is located a short distance from the works it serves. Two products are delivered at these works: First, heating gas for supplying a large number of heating furnaces; second, electric current at 220 volts for lighting the entire works and for serving about 500 h.p. in motors. The entire electrical system is direct-current. Lighting is done directly at 220 volts, and motors are used for general power purposes, including sizes ranging as high as 50 h.p. The power plant thus supplies power for machine tools, hammer, drop and trimming presses, forges, abrasive machinery, and group drives. About half the factory is now operated by gas power, the old steam plant being still in service. The use of gas power at these works was begun about three months ago, and the service resulting has been so satisfactory as to bring about immediate increase in the generating capacity. When this is installed steam power will be entirely discarded.

The Power Building.—Fire-proof construction throughout characterizes the power building. The walls are of brick, pilastered for the support of roof trusses and crane runways. The engine room and basement floors are of concrete, the producer house floors of brick below and boiler plate above, while the roof is of reinforced cinder concrete. Winding iron stairways communicate between the various floors. All electric wiring in the building is carried out in iron conduit with cast-iron junction boxes, thus reducing to a minimum the hazard of a possible gas explosion. Ventilation in the producer house is assisted by a suitable monitor in the roof.

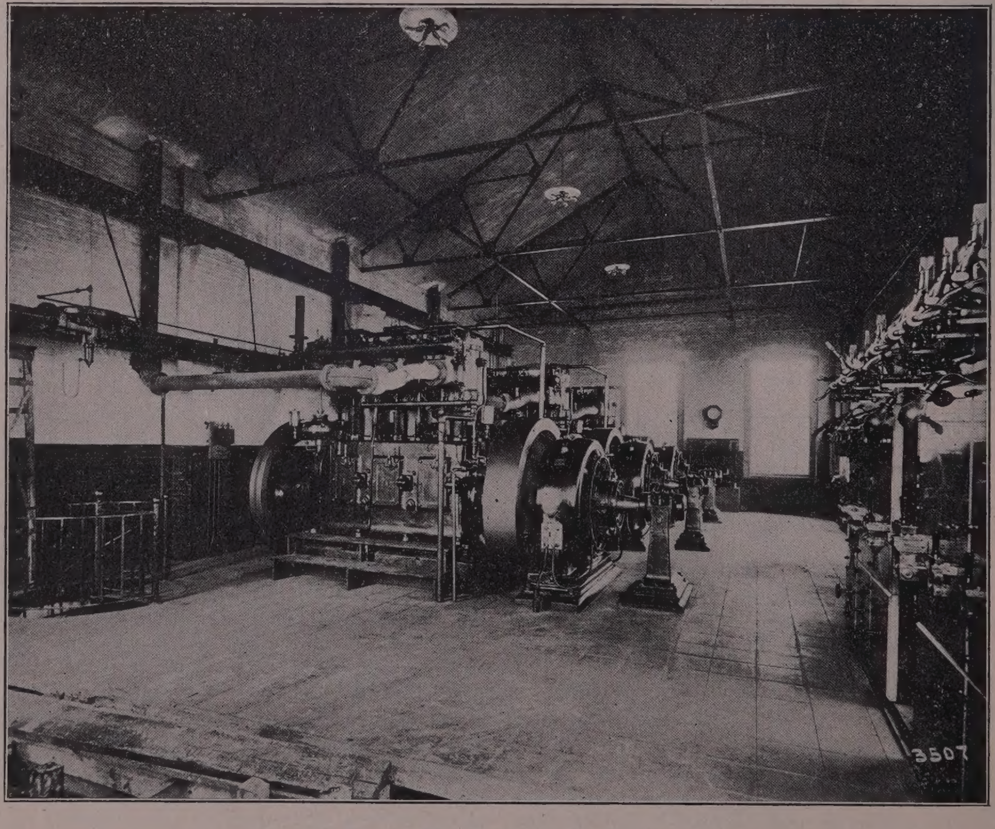
Both producer and engine rooms have one temporary wall so as to be readily enlarged to accommodate future demands for power. A coal siding paralleling one side of the power building delivers coal to an elevator boot beneath, whence it is transferred to the second or charging floor of the producer house by a motor-driven bucket elevator, as shown in the accompanying drawings. The plant is compact, but not too much so, and ample working space exists at all points. The engine room is approximately 20 x 57 ft. with 16 ft. in the clear and an 8-ft. basement; the producer house is 33 x 42 ft. in size, with two 16-ft. stories.

Power-Generating Equipment.—At present three generating units are supplied, each of 75-kw. capacity, and a fourth unit of 100-kw. capacity is now being erected so that the total capacity of the plant is about 500-h.p. The equipment is of standard Westinghouse construction, with three-cylinder enclosed-type gas engines and compound-wound, engine-type, direct-current generators. A noticeable feature of the unit is its general accessibility from both floor and the iron gallery. Ponderous bed plates have been dispensed with, and engine, generator and outboard bearing rest directly upon separate concrete piers with adjustable sole plates to permit centering the generator and bearing. A single I-beam trolley crane makes it a simple matter to inspect the engine periodically, and facilitates work of any kind on the equipment.

The accompanying drawings show clearly the method of piping, both supply and exhaust. The former is controlled by an ordinary cast-iron gate valve and automatic regulator, which so compensates for the pressure upon the supply main that the gas is delivered to the engine at approximately atmospheric pressure. Each exhaust extends horizontally to the building wall and up through the roof, this being necessary to pass behind the crane track. In the case of the new unit the exhaust will be carried directly outside, as this part of the engine room extends beyond the producer house. The noise from these exhausts is very slight, not more than from an ordinary non-condensing steam engine.

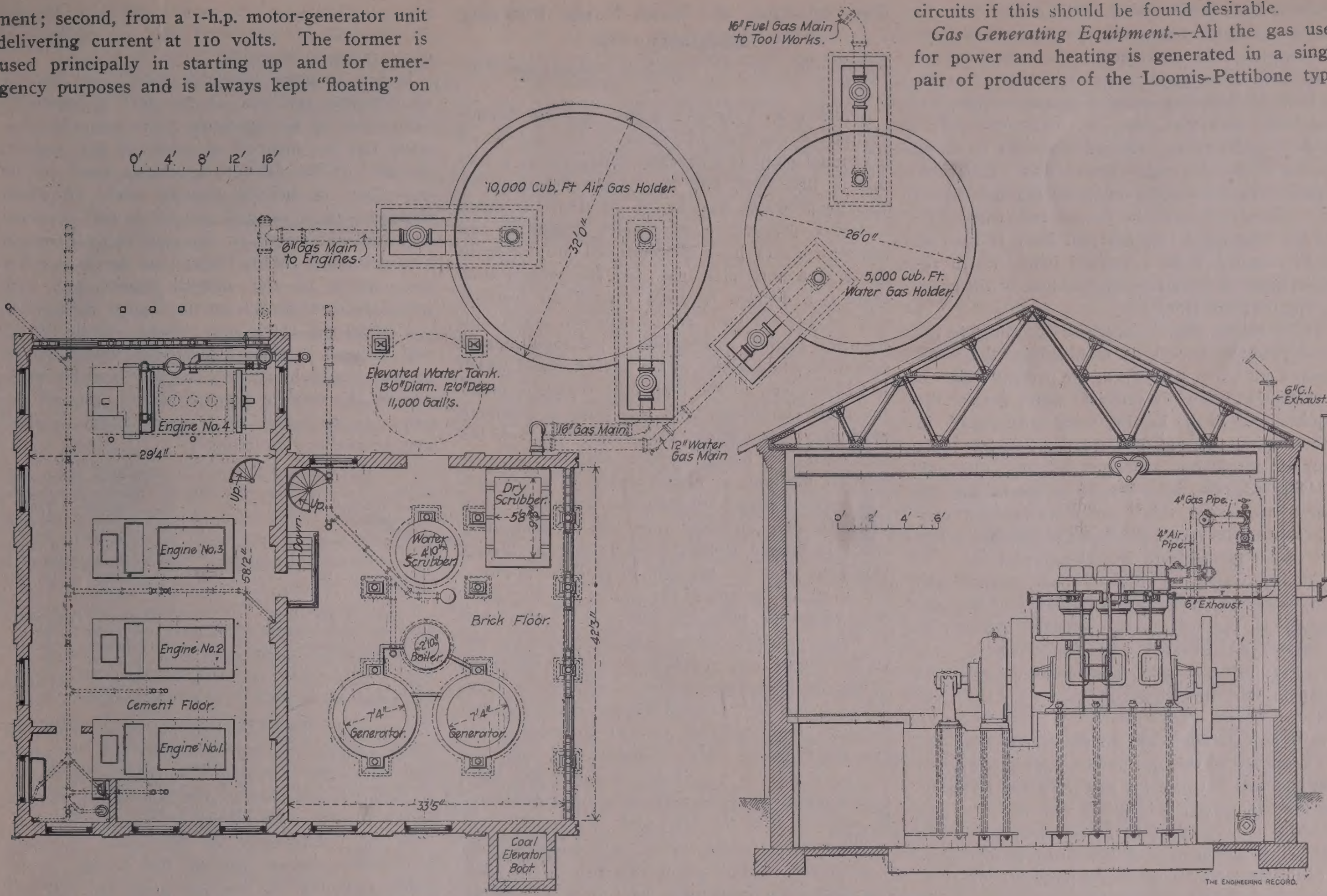
Air and gas are mixed in proper proportions at the engines by a pair of plug valves with graduated indices from which the proportion may be observed and altered from time to time to accommodate variations in the quality of gas delivered to the engine. The mixture then passes to a controlling valve of the poppet type, which is connected directly with the governor and proportions the quantity of mixture sent to the cylinders, according to the load on the engine. Ample speed regulation is afforded by a sensitive flyball governor for operating the units satisfactorily in parallel, and speed may be adjusted to a nicety while the engines are in operation.

Two sources of ignition current are available: First, from a six-cell storage battery in the base-

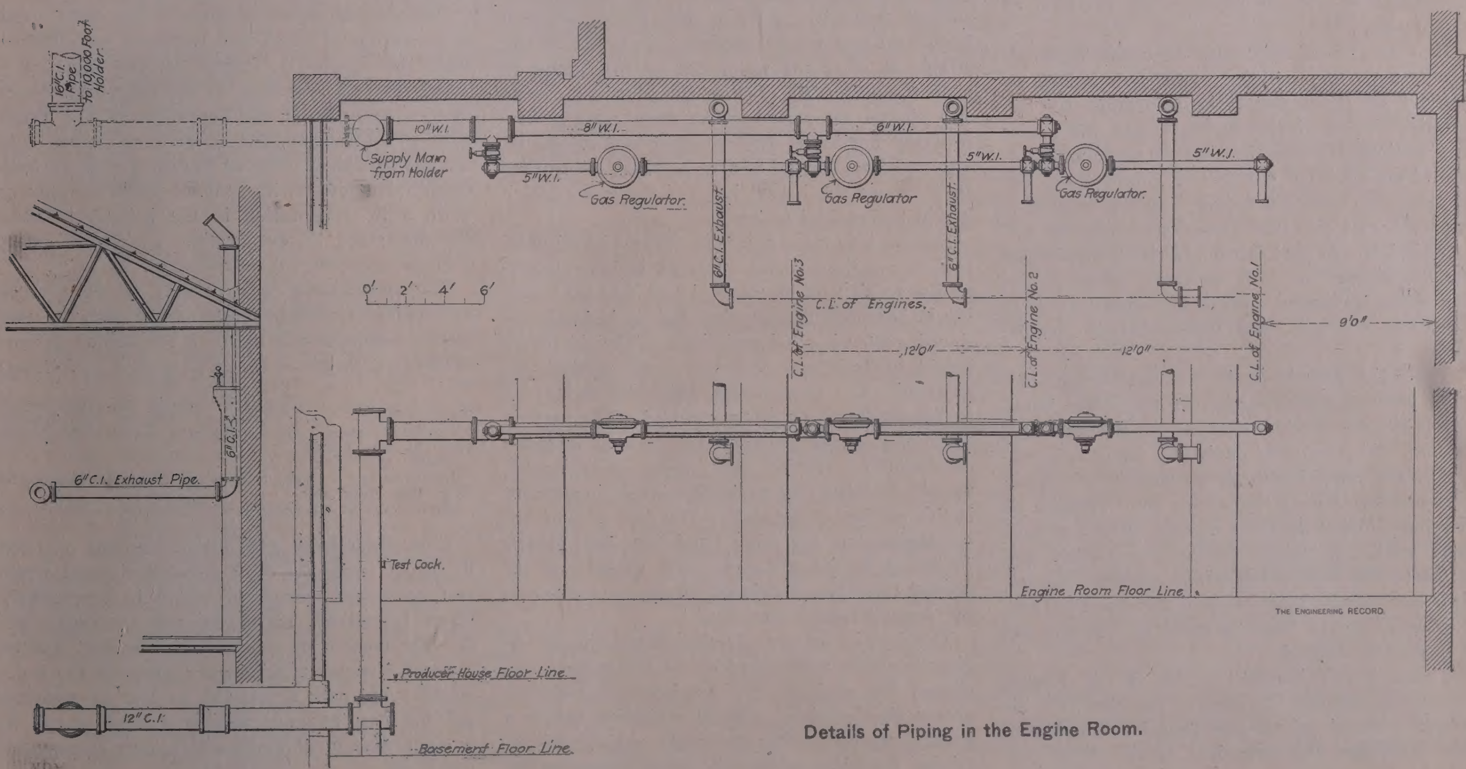


Interior View of the Engine Room.

ment; second, from a 1-h.p. motor-generator unit delivering current at 110 volts. The former is used principally in starting up and for emergency purposes and is always kept "floating" on the electrical system so as to be fully charged at all times. A small switchboard on the wall at the rear of each engine, convenient to the throttle, primarily controls this ignition current.



Plan of Gas Engine and Producer Plant and Section of Engine Room.



Details of Piping in the Engine Room.

The starting of the plant is readily accomplished in the usual manner by means of compressed air stored in the basement in galvanized steel tanks, eight in number. A small motor-driven compressor, also in the basement, is used for compressing this air, which is normally carried at about 180 lb. pressure.

Control of generating equipment and all lighting and power circuits is centered in a neat six-panel switchboard of Westinghouse construction fitted with round dial instruments and carbon-break circuit-breakers. All cablework is laid in iron-pipe-protected conduit. Duplicate busses provide means for the isolating power and lighting circuits if this should be found desirable.

Gas Generating Equipment.—All the gas used for power and heating is generated in a single pair of producers of the Loomis-Pettibone type. The generators, each 7½ ft. in diameter, are charged from the second floor where the coal is delivered from the elevator. Air and water gas are generated in the producer as usual at alternate intervals in quantities sufficient to meet the demands. Water gas is sent directly to the holder from a vertical wet scrubber containing eight layers of broken stone, coke, and excelsior in the order named. The air gas, sometimes called producer gas, before being sent to the holder, is passed through a rectangular dry scrubber containing excelsior, in addition to the wet scrubber. Even with these precautions, however, a certain amount of flocculent carbon escapes to the engines, but with apparently no detrimental effect if the regulators are cleaned out two or three times a week. An engine-driven Root's exhauster furnishes the required suction during the "blowing" of the producers, or air-gas run, while during the water-gas run a steam blast is used as usual, supplied from a vertical boiler which reclaims much of the waste sensible heat of the gases leaving the generator.

The producer plant is operated according to the usual practice, except as modified by the small demand for water gas just at the present time. It thus occurs that, while sufficient water gas for the requirements of the heating work can be made in a three-minute run to fill the holder, air gas must be made for fifteen or twenty minutes, although at reducted rate, in order to maintain the required heat. On this account there is a considerable excess of air gas made at present, which has to be turned into the purge pipe.

Cooling water for the scrubber, water-jacketed valves and also for the jackets of the gas engines is supplied under constant head from an 11,000-gal. elevated water tank, which is in turn kept full by a 3-in. motor-driven centrifugal pump located at a short distance upon the river bank.

Cost of Operation.—From the above details of the operation of this gas power plant it is evident that the fuel expense for power is low. The air gas used for power is identical with the blow gas, which is a by-product in every water gas plant, and which would here be a waste product unless it could be put to some useful purpose. Furthermore, the cheapest grade of bitminous run-of-mine coal is used for gasification purposes, which tends to further reduce the costs of the products of this station.

It is at present impossible to obtain economic results upon the operation of the power plant on account of the difficulty in separating the respective duties of the fuel gas and the power gas sections. When the plant is completely installed an efficiency test will be conducted to determine this matter definitely. In any case it is apparent that the true power cost must be extremely low. As fuel cost is practically eliminated, the remaining items of operating expenses on the power equipment with fixed charges on same, constitute the sole legitimate charges against power.

The labor item is small, two men being sufficient to handle each section of the power house except in the weekly cleaning of the gas generators, which requires additional labor in breaking up and removing the large quantity of clinker accumulating during the week's run. Repairs on the plant during the three months of its run have been small, particularly on the power plant, and in short, the station has given excellent service. It is a prominent illustration of the successful production of power from "greased air," as the gas is popularly termed.

The writer is indebted to Mr. F. A. Phelps, consulting engineer, designer of the plant, for his Works, through whose assistance it is possible to Mr. Hausman, superintendent of the Atha Tool Works, through whose assistance it is possible to present the information concerning this interesting plant.

Four 27-in. Electrically Driven Centrifugal Pumps, with a combined capacity of 52,000 gal. per minute against a total lift of 45 ft., built for a dock pumping plant in England, have 38-in. cast-iron impellers running at 375 r.p.m.

The Selection of Water-Works Pumping Machinery.—II.

By Nicholas S. Hill, Jr., Consulting Engineer, New York.

Selection of Type of Engines.—Careful consideration of the type of engine to be used in an individual plant is frequently conducive to a saving in first cost, and the proper selection invariably produces economy in operation. In many instances prospective purchasers, engineers and superintendents have preconceived prejudices in favor of a particular type. At the present time there is a decided tendency toward the installation of the vertical, triple-expansion, crank and fly-wheel engine, irrespective of the conditions of operation, due perhaps to the advertisement which has been given to the high duty obtained, under favorable conditions, with this class of pumping machinery. As before mentioned, however, the pump with the highest duty is not the most economical machine to install under all conditions. The vertical engine occupies less floor space than the horizontal, therefore when the available floor space is limited it may be necessary to specify this type, or when the cost of land is excessive, the saving in the cost of the station site may more than offset the increased first cost of this class of pump. Again, where coal is expensive, the vertical engine may, owing to its greater efficiency, reduce the operating expenses sufficiently to more than pay for the increased interest charges due to the high initial cost of vertical machinery. On the other hand, where property and coal are cheap, or the space available is ample, the horizontal engine, while performing a lower duty, may be economical in the total cost of pumping.

The same reasoning applies in choosing between a compound or triple-expansion unit. Many other considerations, depending upon local conditions, affect the selection of the type of engine best adapted to individual plants. The condition of suction frequently governs the choice between horizontal and vertical engines. It is always desirable to place the water end of the pumps as near the water as practicable, while the steam end should be placed above high water. The ordinary horizontal type of reciprocating pumping machinery should seldom be placed more than 18 ft. above the lowest level of the water which it will be required to handle.

Several important points in favor of horizontal engines are the reduced expenses in labor, accessibility to all working parts, lower first cost, saving in basement construction and, in bad soil, reduced cost of sub-foundations. The increased height of buildings necessary with vertical engines will, as a general rule, offset the saving due to the smaller floor space required. The vertical pump may, owing to its greater economy in steam consumption, require less boiler horse-power, thereby necessitating a smaller initial investment in this portion of the plant. The duty of horizontal engines, on the other hand, has been greatly increased in the past few years so that, at the present time, the margin of difference in favor of the vertical type is not great.

The question of the selection of the type of engine should be approached by the prospective purchaser, his engineer or superintendent, without preconceived notions, without prejudice, and in a judicial manner, with the single purpose of obtaining the plant which will pump water for the least expenditure per million gallons lifted.

It is gratifying to the water works superintendent, the engineer or the builder, to refer to the high duty performance of a particular engine. It is more gratifying to the stockholder, water consumer, or taxpayer, to see the plant which can pump water at the smallest cost per million gallons with a minimum initial outlay. Undue consideration given to duty performance of the engines in pumping plants may be likened to the dedevelopment of individual play in athletics as compared with team play.

It may be noted here that there is an absence of complete statistics of the cost of pumping. Statements of the operating costs frequently appear, but no mention is made of the interest charges, or the debit to a sinking fund (or its equivalent in private plants), both of which charges form an integral part of the cost of pumping, and without which the total expense cannot be ascertained. Many towns issue bonds to cover the expense of any unusual repairs, and such items are eliminated from the reports rendered.

Vertical and Horizontal Pumps.—While the actual ratio of cost for a particular station cannot be determined in advance without specific information, the relative expense in first cost and expense of operation of triple-expansion engines may be outlined as follows:

First cost.	Vertical.	Horizontal.
Land	Less	Greater
Sub-Foundations	Greater	Less
Foundations	Less	Greater
Buildings	Greater	Less
Boilers	Less	Greater
Auxiliaries and steam piping	Approximately the same	
Stack	Less	Greater
Total	Greater	Less

Cost of operation.	Vertical.	Horizontal.
Interest on investment	Greater	Less
Refunding sinking fund	Greater	Less
Maintenance and repairs	Greater	Less
Labor	Greater	Less
Fuel	Less	Greater
Oil, waste and supplies	Greater	Less

Concretely, the vertical engine, other conditions being suitable for the horizontal type, is advisable where the saving in coal effected by its installation is sufficient to overbalance the increase in the other accounts which its use entails.

In the consideration of the above statement, it is well to recall that the fuel account represents, assuming the average price for coal and efficient machinery, about 33 per cent. of the cost of producing power with steam.

Duties.—The value of maintaining other parts of the station in an efficient condition is well illustrated by Charles A. Hague, of New York, in a paper recently presented to the American Water Works Association, and reprinted in The Engineering Record, in which he gives the actual duty in coal consumed with an engine giving an indicated horse-power with 12 lb. of steam as follows: With 8 lb. evaporation in the boilers, 120,000,000 duty; 8½ lb. evaporation, 130,000,000 duty; 9 lb. evaporation, 135,000,000 duty.

The approximate relative duty of three types of engines of efficient design, which may be used for the comparison of units of ten million gallons or over and heads of 100 ft. or over is as follows:

Type. Stage.	Vertical. Triple.	Horizontal. Triple.	Horizontal. Compound.
1,000 lb. dry steam	170,000,000	160,000,000	150,000,000
1,000 lb. superheated steam 500° Fahr. temperature	185,000,000	175,000,000	162,000,000
85% test duty dry steam	144,500,000	136,000,000	125,000,000

With heads from 40 to 100 ft., the duty on 1,000 lb. of dry steam for the vertical, horizontal, triple and horizontal compound would be respectively about 155,000,000, 145,000,000 and 135,000,000 ft.-lb. For engines of smaller size, the duty will be lowered somewhat, although engines of the horizontal type, with a capacity as low as 3,000,000 gal. per day, pumping against a head of 150 ft. or over, may be obtained with a duty of 125,000,000 ft.-lb.

Steam Pressure.—The steam pressure has a material bearing upon the choice between a compound or triple-expansion pump. A compound engine designed with a proper cylinder ratio, cut-off and piston speed, will probably be equally as effective as the triple-expansion, at 120 lb. steam pressure, and more economical at lower pressures. If the pressure is not previously fixed by an existing boiler plant, it is advisable to use at least

160 lb. when triple-expansion engines are installed.

Size of Units.—The capacity of the units selected should be considered with regard to different lifts. The size of the steam cylinders and other large castings is limited in order that they may not be too large for economical handling in the shops and while in transit. As the engine will produce the greatest economy when running at its rated capacity, the daily and seasonal fluctuations in pumpage should be studied in their relation to the most efficient subdivision of units.

It is always well, as indicated in the preceding specifications, to state the limits between which the pump may be reasonably expected to operate, and provide for an emergency capacity at least 25 per cent. in excess of the nominal rated capacity. Such an allowance will usually cover the daily variation likely to occur when adequate storage is provided.

In the event of direct pumpage into the mains, the question of the size of units becomes more important, and the subdivision of units to care for the day and night consumption will be found economical. The seasonable fluctuations will, in most localities, scarcely be met by the emergency capacity, in which event the pumpage of the unit or units must equal the maximum, and operate below their rated capacity at other times unless one or several engines are designed to supply the minimum demand, and additional units are provided to take care of the excess.

Piston Speeds.—The present tendency toward higher piston speeds in pumping machinery is noticeable, and the limit of improvement in this regard has not been reached. There is no reason, from the viewpoint of the designer, why the plunger displacement per stroke should not be reduced, the number of strokes per minute increased, and the percentage of plunger area in valve seats increased, so as to maintain the proper velocity of water through the valve openings.

Cylinder condensation is an inverse function of the piston speed, and undoubtedly the losses from this cause, which are always considerable, have been especially heavy in pumping machinery running at the piston speeds heretofore adopted, as compared with steam engines of efficient design used for other power purposes. It is undoubtedly true that increase in piston speed is not a panacea for all difficulties encountered in design, but the writer believes that, other conditions being the same, the pumping engines which have established notable performances would have done better if designed to run at a greater number of strokes per minute. It is safe to specify speeds not higher than 360 ft. per minute on the larger sizes of pumps.

Superheating.—Superheated steam has recently been introduced extensively into the United States, although it has been economically used on the continent for some years. Its use results in a saving in fuel varying from 10 to 20 per cent. Data are not obtainable regarding its effect upon the maintenance account. Contradictory reports appear in relation to the injury caused by the high temperature to packing, valves, etc. On the other hand, superheat does away with the expense and nuisance of steam jackets, which will probably more than offset the expense arising from its use.

Opinions differ as to the degree to which superheating should be carried. Probably 250° superheat at the throttle, with properly designed reheaters, will be reasonable. Superheated steam should be used in a plant where the price of coal and quantity of water pumped warrant a high efficiency. Its use may ultimately require some modification of the steam valves and packing.

Direct-driven or attached auxiliaries should be specified owing to the great efficiency of this class of machinery when thus operated.

There are many other details to be considered in the selection of pumping machinery usually installed in American waterworks plants.

Well Pumps.—With well supplies special pumping apparatus has to be installed to raise the water to the surface unless flowing wells are encountered, the water from which will flow by gravity to a receiving or collecting basin, from whence it may be pumped as outlined above, into the mains, to a standpipe or reservoir. For this purpose several systems have been devised, chief among which may be mentioned the steam-vacuum pumps used to relieve the main pumps of an excessive suction lift where the distance between pump and water surface is not greater than the maximum lift possible with an obtainable vacuum. Other methods include the air-lift, direct-acting deep-well pump and power pumps operated hydraulically by reciprocating steam engines, steam turbines, gas and oil engines, or electric motors. Some examples are extant of pumps depressed to increase the yield of deep wells and located in pits 50 to 100 ft. deep. Such a plant was installed in Memphis in 1891 with vertical compound engines having a duty of 115,000,000 ft.-lb., and pumping directly into the system without the need of secondary pumpage.

In Rockford, Ill., two pumps of the centrifugal type, operated through rope transmission by compound engines located on the surface, were similarly placed. The pumps alone developed an efficiency of from 70 to 75 per cent., and the whole plant a duty of 58,000,000 ft.-lb. per 1,000 lb. of steam. The wells were connected up by means of collecting tunnels, containing the pipes.

Other special designs might be mentioned, but the above is sufficient to show the diversity of method employed in lifting ground water supplies. Frequently power pumps are used to pump directly into the reservoirs, standpipe or pipe system. With the air lift, secondary pumping is usually necessary or more economical, unless the wells are located at an elevation sufficient to allow of distribution from the collecting basin by gravity. Direct pumping to a reservoir at the necessary elevation may be employed with this method, and the water distributed by gravity, provided the water level in the wells is at such a height and the wells sufficiently deep to maintain the necessary submergence of the air discharge. The relative cost of these various systems, or the several combinations or modifications thereof, depends upon the local surroundings.

Power Pumps.—The question of the motive power and type of prime-mover to be used with power pumps is largely a matter of local consideration. Steam is frequently employed in reciprocating engines of different types. The gas or oil engine is in some instances less expensive in fuel consumption, while in places it is advisable to use electric power.

A recent example of an electric pumping station is found at Schenectady, N. Y. The two pumps are 18-in., two-stage, vertical-shaft, turbine type, of 12,000,000 gal. capacity each, built by H. R. Worthington. The pumps are installed in a 21-ft. pit, and draw water through a 42-in. suction pipe from two circular wells 42 and 35 ft. deep and 50 ft. in diameter. The vertical shafts of the two main pumps extend to the station floor, and are direct-coupled to the motors.

The duty of the different classes of steam-driven engines may be estimated as follows:

Duty per 1000 lb. Steam.

High-duty engines	100-180	millions.
Pumping engines	75-100	"
Large well-designed pumps	30-70	"
Centrif. pumps, comp. cond. recip. engs.	75-90	"
Direct-acting well pumps	2-6	"
Vacuum pumps	2-8	"
Power pumps; simple H. S. engines	40-50	"
Power pumps, simple Corliss engines	60-75	"
Power pumps, simple comp. cond. C. engs	75-90	"
Power pumps, simple triple exp. C. engr.	90-115	"
Air lift with comp. Corliss cond. comp.	25-30	"
Air lift with simple Corl. non-cond. comp.	10-15	"
Air lift, well-designed h.p. compressor	10-12	"
Air lift straight line	5-10	"

In small plants lifting either surface or ground water, gas and oil engines may be employed to advantage.

Electrically driven, or gas-engine-driven multi-stage centrifugal pumps are exceedingly useful in certain classes of work, where the load factor is low, service intermittent, and pumping irregular. Under these conditions the advantages of the high-duty pumping engine are greatly diminished, and its economy materially decreased.

The centrifugal pump is economical where large quantities of water are to be raised under a low lift. When current can be purchased at reasonable figures, and in sufficient quantity, electrically driven multi-stage centrifugal pumps for fire service are cheap in first cost, and economical in operation.

The steam turbine has recently been extensively introduced, and there is reason to believe the turbo-driven multi-stage centrifugal pump will be useful and efficient under numerous conditions. The developments along this line, however, have not been of a character to warrant a statement of the efficiency of such a unit.

It is impossible in a short article like this to fully cover so large a field. An endeavor has been made in what precedes to give a brief outline of the subject.

Pumping Station Design.—The building should be neat, substantial and attractive in appearance, and suitable for the purposes for which it is intended. Aesthetic design should be subordinated to utilitarian considerations. It is entirely possible, however, to combine architectural beauty with practical construction. If the pumping station is located in a public park or attractive neighborhood, its architecture should be made to accord with its surroundings. A proper consideration of the appearance of the building does not necessarily incur additional expense.

I know of no better example of a simple, chaste and appropriate building adapted to its surroundings than that of the Spot Pond pumping station at Boston, Mass.

It is usually safe to construct a building sufficiently large to allow for the installation of additional boilers and engines. The station, if permanent in character, and of sufficient size, should be built of the best fire-proof materials under thorough inspection. Brick, stone or concrete should be used in the walls, brick or concrete for foundations, and concrete boiler room and basement floors. Steel beams should support a tiled flooring in the engine room. The interior walls should be finished with enameled tiling, preferably light in color. Steel roof trusses and tiled roof should be used. A sufficient clearance should be provided between the engine room floor and foundations, or engine frames to prevent transmission of the vibration of the machinery to the flooring or building. Sufficient drains should be provided in the basement and boiler rooms. It is well to have a clear-story running the entire length of the engine room, equipped with movable window sash operated from the engine room floor.

Unless proper ventilation is provided at the roof, the heat in warm weather on the galleries of vertical engines is so great as to deter the men from properly inspecting the machinery, and the condensation which takes place in cold weather makes it difficult to keep the engines and station clean.

Suitable ventilators of large size should be placed in the roof of the boiler room. The windows should be large enough to give abundant light, and a free circulation of air. The doors should be of sufficient size to admit the largest machine part to be installed. Care should be exercised to secure ample illumination at night. It is well to provide stairways at convenient locations to connect the basement and engine room floor. Access to the boiler room should be made quickly and easily. Neat toilet and wash rooms, with bath and lockers of proper dimensions will be conducive to general efficiency and much appreciated by the men.

Provision for the storage and ventilation of an ample supply of coal is necessary, and consideration of the most efficient and economical method of handling coal and ashes will reduce the operating cost. If possible the station should be located at a point where fuel may be cheaply delivered.

A fire-proof oil storage vault, provided with separate tanks for cylinder, machine and other oils with outlet pipes to the surface, so that the barrels may be emptied by gravity, will be found safe, convenient, clean and saving in the use of oil. Lubrication may be provided from the tanks by a central oil pumping system, and automatically returned after filtration, or pumped by hand with the necessary apparatus on the engine room floor, and supplied the machinery with the usual oil cups and lubricators.

A tool room and small machine shop is almost necessary to limit the cost of maintenance and allow small repairs to be made by employees without the necessity of sending for outside help.

The elements conducive to pumping water cheaply are: Efficient engines and boilers, the latter carefully fired; the engines operated continuously at their rated capacity, or at an overload within the limits for which they were designed; simplicity and directness in steam and water piping within stations; the preventon of radiation from boilers, steam pipes and cylinders; the heating of feed water by waste heat, and supplying dry or superheated steam; and the minimum amount of auxiliary machinery operated otherwise than by the main engine.

Arrangement of Station.—The general layout of the station should be modeled after the style of plan adopted in modern power station design, viz.: the engine and boiler rooms should adjoin each other, the machinery being placed on each side of, and perpendicular to the dividing wall, thereby minimizing the length of pipe, the loss of condensation and friction resulting from long lines of steam main and facilitating the safe subdivision of the steam lines by properly located valves, so that the entire station will not be thrown out of service in the event of a break, or to make repairs.

This plan also facilitates the extension of the engine and boiler rooms in the same direction, in case of subsequent extensions, and maintains, as such extensions are made, the relative location of the engines with regard to the boilers.

This style of construction makes it possible to add to the station without disturbing the continuity of the engine room, boiler room or steam piping. It permits of installing the shortest possible steam line, and keeping the main headers in the boiler room. The only piping which need be visible in the engine room are the leads to the engines from this header, and in many cases these may be carried under the engine room floor.

One engine room running in the same direction enables the engine man to keep all the machinery under his immediate inspection and control. The adjacent boiler room makes it easy of access from any part of the engine room. The custom of placing the engine at one end of the building, and the boilers at the other, is inconvenient from an operating standpoint and expensive in the cost of steam distribution, steam condensation and losses due to friction in the steam main.

The engine room should be provided with a crane to operate the whole length of the station and serve every part of it. The crane is advisable, as it will materially affect the bids on machinery.

Boilers.—Water-tube boilers should be preferably used on account of their safety. The boiler should be provided with the proper grate area to suit the quality of coal used, and have ample heating surface, so that the rate of evaporation will not be greater than about 3 lb. of water per square feet of heating surface per hour, from a feed temperature of 212° F., into steam at atmospheric pressure.

It is important, after accurately determining the maximum number of pounds of steam that will be used by the various engines and auxiliaries in a plant, and amount of heating surface necessary to evaporate the required water on the basis above named, to consider the subdivision of the heating surface into the proper number of boilers or units.

The ratio of the grate area to the heating surface would vary with the kind of coal and the amount burned. From the knowledge of the number of pounds of water to be evaporated, and the amount one pound of a given kind of coal will evaporate under ordinary conditions, the quantity of coal which must be burned in a given time can be calculated. Knowing the amount of coal that must be burned, and the amount which should be burned on each square foot of grate surface in a given time, the amount of grate surface can be determined.

With ordinary bituminous or semi-bituminous coal, the amount burned per square foot of grate surface per hour varies from 15 to 22 lb., and with anthracite coal from 12 to 15 lb. These rates may be increased with mechanical draft. As the station load is comparatively regular in pumping stations, it is not customary to find mechanical draft in such plants. The boiler settings should be given careful attention and proper inspection, and ample provision made for the care and cleaning of the boilers. Mechanical stokers are not recommended as economical, except for use with low grade of coal.

Auxiliaries and Piping.—Where attached auxiliaries are used, economizers should be installed for the purpose of heating the boiler feed, thereby utilizing the waste heat, which would otherwise escape through the flue. If independent auxiliaries are used, the exhaust steam from these will probably be ample to elevate the temperature of the feed water sufficiently.

Especial care should be taken in the design of the steam piping and joints if superheated steam is used. The Van Stone type of flange joint, with corrugated gaskets, will give good service. Proper bends should be used in place of cast elbows, wherever possible, to save loss of pressure due to friction, and to provide for the contraction and expansion in the steam main.

An automatic system for returning the condensation from all high-pressure drips to the boilers should be installed. Independent air vacuum and boiler feed pumps should be provided for use in the event of a shutdown at the station, or in case the attached pumps become deranged.

Independent auxiliary machinery, regularly operated, will probably reduce the station duty from 5 to 10 per cent., according to the size of the plant.

Letting Contracts.—A convenient and systematic method of letting the contracts would be as follows:

Call for bids on all the pumping machinery, as per specification, together with separate bids for any auxiliary machinery, such as dynamos, with the necessary engines to drive the same, etc. When the style of engines and pumps has been decided on, the necessary data will have been furnished to call for bids on boilers, stacks, economizers, superheaters and auxiliaries.

When the contracts for these portions of the plant have been let, the necessary data will have been acquired to proceed at once with the design of the station.

Operation.—Attention to the details of firing and engine driving, which adds almost nothing to the expense and is insisted on during the duty trial, is often abandoned as soon as the test is over. It is customary for the engine builder to adjust the machinery and see that everything is in the best condition for the highest efficiency before the official duty test is made. Gauges, thermometers and indicators are used to adjust pressures in the steam cylinders and jackets, to record temperatures of steam, flue gases and feed water, and to show the steam distribution of the cylinder. The use of these instruments is absolutely essential to good economy, and in order to maintain the plant in good condition they should be made permanent adjuncts instead of being removed or neglected when the duty trial is completed.

Hourly records should be kept of the revolutions made by the engines, amount of water pumped, total lift on pumps and fuel consumed, as well as of all pressures and temperatures, and a daily record should be kept of all supplies used, notes being regularly made of any unusual occurrence about the machinery or station. Indicator cards should be taken and computed, from both the water and steam ends, as often as it is found necessary to keep the engines in good order.

Supplies in sufficient quantity, and duplicates of small parts known from experience to require renewal frequently, should be kept on hand. Lubricants, while not wasted, should not be curtailed. Efficient means should be provided for preventing waste. A sufficient number of men should be employed to accomplish all the work readily, and in a systematic and thorough manner. Each man should be assigned certain duties, and carefully instructed in the method of performing them.

The men should be allowed a regular day off at least once per month where they are compelled to attend machinery which must run seven days in the week, and such provision should be enforced without discrimination. The period of service should not exceed eight hours per day.

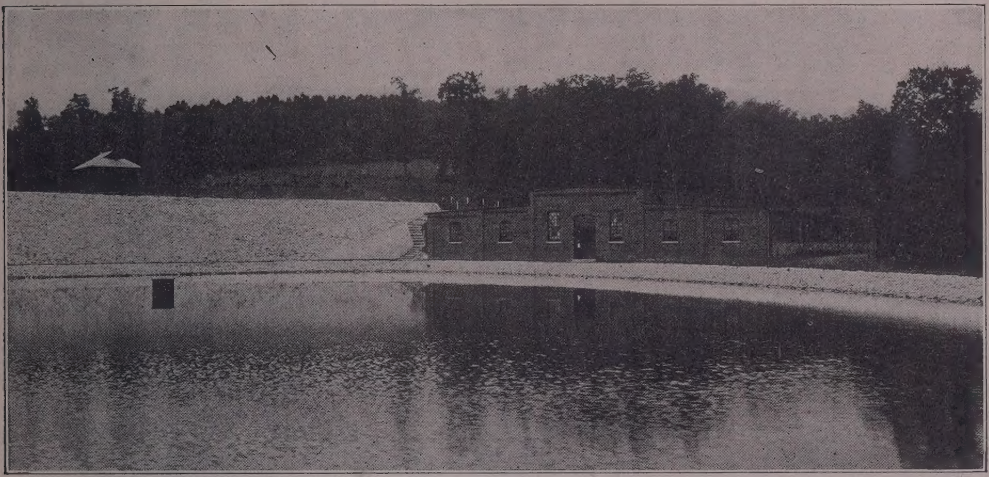
Repairs should be attended to promptly by employees of the station, unless too large and requiring parts which cannot be made at the station.

Revolving Sewage Screens.

Revolving sewage screens which are self-cleaning and entirely automatic in their action have been installed at the Cole Valley and Sutton Coldfield outfall sewage works of the Birmingham, Tame and Rea District Drainage Board under the direction of Mr. John D. Watson, engineer of the Board. The screens are perforated, flexible, endless metal belts inclined at an angle of 30 deg. and running over a horizontal revolving drum at each end, the lower drum immersed in the sewage. The drums are placed transversely across the channel through which the sewage is passed and are operated by a Poncelet waterwheel driven by the flow of the sewage, the speed at which they revolve and the capacity of the screens varying with the changes in the amount of sewage flowing. The intercepted material is lifted out of the sewage and carried around the upper drum, where a rotary brush cleans it off and transfers it to a worm conveyor placed transversely in the rear of the screens and discharging in a barrow or truck at one end. The brush and conveyor are also operated through sprocket chains and a countershaft by the waterwheel. A screen made up of two belts, with a capacity of 3,000,000 imp. gal. per 24 hr., is in operation, according to Engineering, and provision is made for additional apparatus alongside that installed, the conveyor being long enough to receive screenings from it. The screens were constructed by John Smith & Co., Carshalton, England, who have installed similar apparatus in various works, with capacities of screening from 100,000 to 3,000,000 imp. gal. of sewage per 24 hr., two or more screens handling larger amounts.

Water Purification at South Bethlehem, Pa.

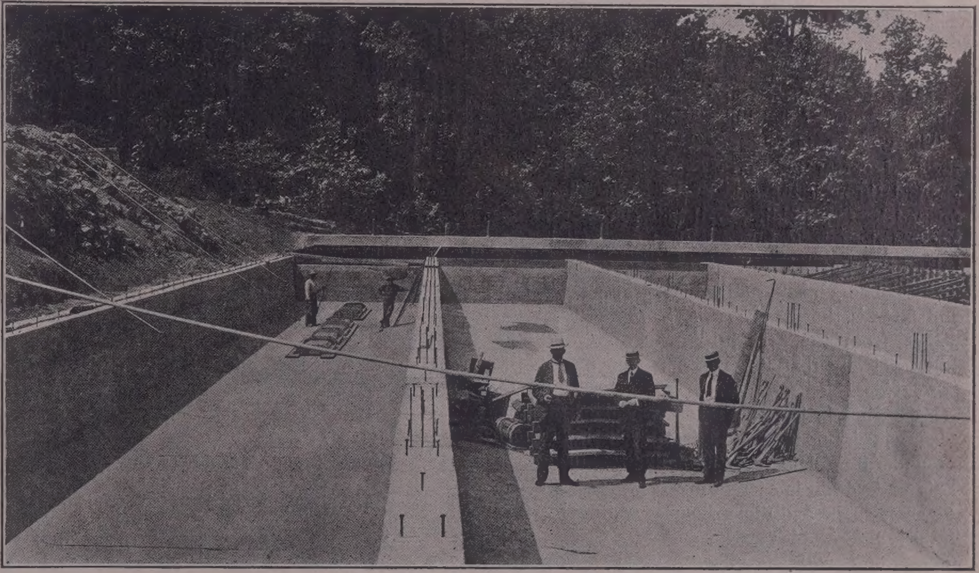
A large part of Bethlehem and all of South Bethlehem, Pa., are supplied with water from the Lehigh River by the Bethlehem City Water Co. The river water is soft and generally free from an unusual number of bacteria, but during freshets a considerable amount of fine culm from coal mines gives it a deep black color, and at other times the wastes from large steel mills impart a reddish appearance to it. The chemical quality of the water is always good, however, as these impurities are only in suspension, and the water is also free from objectionable odor or taste. Epidemics of typhoid fever that have occurred in the two towns in recent years, usually after the spring freshets, have been attributed to the pollution of the water supply. A slow-sand filter plant has been built to treat the water so recurrences of such epidemics may be avoided and the water clarified.


The Filter Plant, Storage and Filtered Water Reservoirs, South Bethlehem Water Works.

The brick pumping station of the water company is located at the base of a steep hill between the tracks of the Lehigh Valley R. R. and the river. The pumping plant consists of a 5,000,000-gal. horizontal cross-compound double-acting high-duty Holly pumping engine and a 2,500,000-gal. Dixon single-acting pump, both supplied with steam from three 100-h.p. tubular boilers. The water flows by gravity into a 15 x 30 x 8-ft. masonry suction well and is elevated through an 18-in. pipe line, 2,000 ft. long, to a 12,000,000-gal. storage reservoir on a hill 265 ft. above the river. The water formerly flowed by gravity from this reservoir to a 5,000,000-gal. reservoir, about 20 ft. below it in elevation, from which the distribution system is supplied under gravity pressure.

There is no space between the railroad tracks and the river at the pumping station for the location of a filter plant of any kind. An embankment existed, however, near the reservoirs, at the level of the lower one and on a steep side hill, which could be widened to provide room for the filters. This embankment was extended and the filter plant built upon it. The relative location of the basin and the filter building is shown in an accompanying illustration. The larger basin is above on the left and is used as a storage and subsidence basin; the smaller basin in the foreground is used as a filtered water basin.

The ultimate capacity of the filter plant is 4,000,000 gal. per day. The normal consumption at present is 2,500,000 gal. per day. The plant consists of a one-story 106 x 205 ft. 9 in. brick building containing six 16 x 182-ft. open concrete tanks, 6 ft. deep and divided 37 ft. 6 in. from the rear end by a transverse wall 5 ft. high. The six tanks are built in a row, with concrete division walls between them, and the sidewalls of the building resting on the outside walls of the end bed. The rear building wall rests on the outer wall of an inlet chamber built in connection with the tanks at the rear, and the front wall on one wall of an effluent chamber in front of the tanks. Considerable rock had to be excavated in bringing a part of the site to grade; the rock being used in extending the embankment and, after being broken in a Kenneth Square crusher, in the concrete. A 12-in. layer of clay puddle containing about 10 per cent. of ¾-in. broken stone was laid over the entire foundation for the floor of the filters as fast as the foundation was prepared. The puddle was mixed in a portable pug mill and laid in layers which were thoroughly tamped into place with heavy iron rammers. As soon as sufficient puddle had been laid to permit concrete laying to be carried on without interruption, work on the floors and walls was begun. The puddle was thoroughly sprinkled immediately in advance of the concrete laying and the concrete well tamped upon it.


Concrete Tanks during Construction, Showing Operating Stands over Inlet Chamber at the Rear.

The entire floor was reinforced with ½-in. square plain steel rods, placed 12-in. on centers transversely and 24-in. on centers longitudinally. An additional reinforcement of 10-in. mesh No. 4 expanded metal was used in the floor over all made ground. The division walls between the tanks, and the walls of the inlet chamber are reinforced, as shown in the accompanying illustrations.

The concrete was mixed wet in a Ransome mixer in the proportions of one part of clean river sand, three of broken stone and five of Bonneville Portland cement. Close to all surfaces this proportion was enriched by the addition of a 1:1 mortar tamped along the face of the forms with flat spades, no plastering whatever being permitted. Wherever thin reinforced slabs were made and where reinforcing metal was imbedded, the concrete was made considerably richer than the regular mixture. The walls are entirely watertight and no settlement cracks have occurred, although a few temperature cracks have appeared which have occasioned no trouble after being filled with asphalt roofing mastic.

The water flows from the 12,000,000-gal. storage reservoir through a 20-in. pipe along one side of the building to the reinforced concrete inlet chamber at the rear of the tanks. This chamber, 3 ft. wide and 8 ft. high, is built transversely the width of the building, its front wall and the rear walls of the tanks being in common. The chamber is covered with a reinforced concrete slab supported on transverse 4-in. I beams imbedded in the slab and in the side walls. The flow in the 20-in. inlet pipe is controlled by a Chapman gate valve, with its stem extending into an indicating and operating stand on the operating floor made by the slab cover to the chamber.

The rear portion of each tank is a scrubber in which the water receives preliminary treatment before being introduced upon the sand beds, which are placed in the portion of the tanks in front of the low transverse division walls. The motion of the water in the scrubbers is from below upward through the filtering material. The depth of the water in the inlet chamber is kept at about 6 ft., which is 6-in. above the normal level of the water in the tanks and represents the head lost in the scrubbers. The supply pipe to each scrubber is an 8-in. cast-iron pipe laid through the division wall between the scrubber and the inlet chamber near the floor line. The flow in these supply pipes is regulated by hand-operated Chapman gate valves with their stems extending up into standards on the floor over the inlet chamber. Each supply pipe is connected by a Y with two lines of 6-in. terra cotta pipe laid the length of the scrubber on the bottom and at equal distances from the center line and side walls. The supply pipe and the terra cotta pipe are laid with tight joints. Each 3-ft. length of terra cotta pipe is perforated with nine 1-in. holes in three rows, one row on the bottom and one row on each side of it at an angle of 45 degrees with the bottom center line. The wash-water drain is a single reinforced concrete conduit of about half elliptical cross section, 2 ft. 9 in. wide and 6 in. high in the clear. This underdrain is laid along the center line of the tank, with its convex side upward, and along each edge of it where it rests on the concrete floor is a row of 2 x 3-in. openings on 7½-in. centers. It is connected at the middle with a 12-in. cast-iron main laid in concrete beneath the floor to an outlet at the rear of the building. The flow in each outlet is controlled by an Eddy gate valve in a valve box just outside the rear building wall and not as shown in one of the illustrations.

The filtering material in the scrubbers is shown in an accompanying illustration. The space between the waste-water drain and the supply pipe is filled with selected 3-in. river gravel. The remainder of the lower foot of filtering material is made up of 3-in. coke. Four layers of 1¼-in. coke, with an aggregate thickness of 2 ft., are placed over the 3-in. coke. In each layer of the 1¼-in. coke are placed regular rows of slates about the size of ordinary roof slates. The rows in the lower layer are placed longitudinally in the scrubber, and those in the layers above it alternately, transversely and longitudinally. The slates in the lower and upper longitudinal rows are inclined about 30 degrees from zero and 180 degrees, respectively; the same amount and relation of inclination is maintained between the two sets of transverse rows. Over the coke containing the rows of slates is an additional 10 in. of 1¼-in. coke, and over that a layer of sponge, originally 18-in. thick, but compressed to make the total depth of the filtering material in the scrubber 4 ft. 6 in. The mass of filtering material is prevented from floating, due to its buoyancy and the upward flow of water through it, by a grillage of 2 x 3-in. cedar slats placed transversely in the scrubber with ½-in. spaces between them. The cedar slats are held in place by longitudinal 6 x 8-in. yellow pine stringers wedged against transverse 12-in. I beams, imbedded at their ends in the concrete of the division and side walls, as shown in one of the illustrations.

The water enters the scrubber through the two rows of perforated terra cotta pipe and passes upward through the coke and sponge. The weir formed by the dividing wall between each scrubber and the filter forming with it one unit is 6 in. below the normal surface of the water in the tanks. The surface of the water in the scrubber and filter is thus at the same level and the water passes from the scrubber to the filter at such slight velocity that its motion is imperceptible at the surface.

Each filter bed is 16 x 152 ft. in plan and 6 ft. deep, with its floor inclined from each side toward an underdrain laid longitudinally its full length. This underdrain is of reinforced concrete and has the same shape and dimensions as the waste-water drain in the scrubbers, with an 8-in. cast-iron main connecting it with the effluent chamber at the outlet end of the filters. Surrounding this underdrain and extending to a height of 18-in. above the floor is a layer of selected river gravel, graded from 3-in. stones at the bottom to ¼-in. ones at the top. Over this gravel is placed 2 ft. of washed bank sand from Birmingham, N. J. Sand which passed a No. 14 sieve and was retained on a No. 80 sieve was used, and it was placed in 6-in. layers, directly over the underdrainage of the bed. The normal depth of the water over the sand is 30 in.

The flow from the 8-in. cast-iron outlet connection to the underdrain of each filter is controlled by an Eddy gate valve with its operating stand on the floor over the effluent chamber. Each operating stand is equipped with an indicating arrangement showing the rate at which the filter it controls is operating. The filtered water is discharged directly from the filter into the effluent chamber and flows from this chamber through a 20-in. cast-iron main to the open filtered-water distributing reservoir in front of the filter building. The cast-iron pipe connections with the underdrains are connected by tees controlled by gate valves to a 6-in. waste-water pipe extending the length of the effluent chamber below the floor over it to a drain pipe at the end of the chamber.

Construction of the plant was begun April 19, 1904, and was finished in the fall, the filters all being put in regular service November 8, after about a month of testing operation. Tests made by the representatives of the water company at intervals since then have shown the plant to have uniformly high bacterial efficiency and to produce a satisfactory chemical effect, although the river water was exceptionally bad during the latter part of the winter and most of the spring. The results of a test made under the direction of Dr. Thomas Darlington, commissioner of health of New York City, to determine the bacterial efficiency are shown in Table I. An examination of the effect of the filters on the chemical quality of the water was made by Prof. Wm. H. Chandler of Lehigh University. The results of this examination are shown in Table II. The time and place of taking the samples upon which the latter table are based were such that the results may not be exactly compared, but they show within a close range the chemical efficiency of the plant.

Table I.—Bacterial Efficiency of Filters.

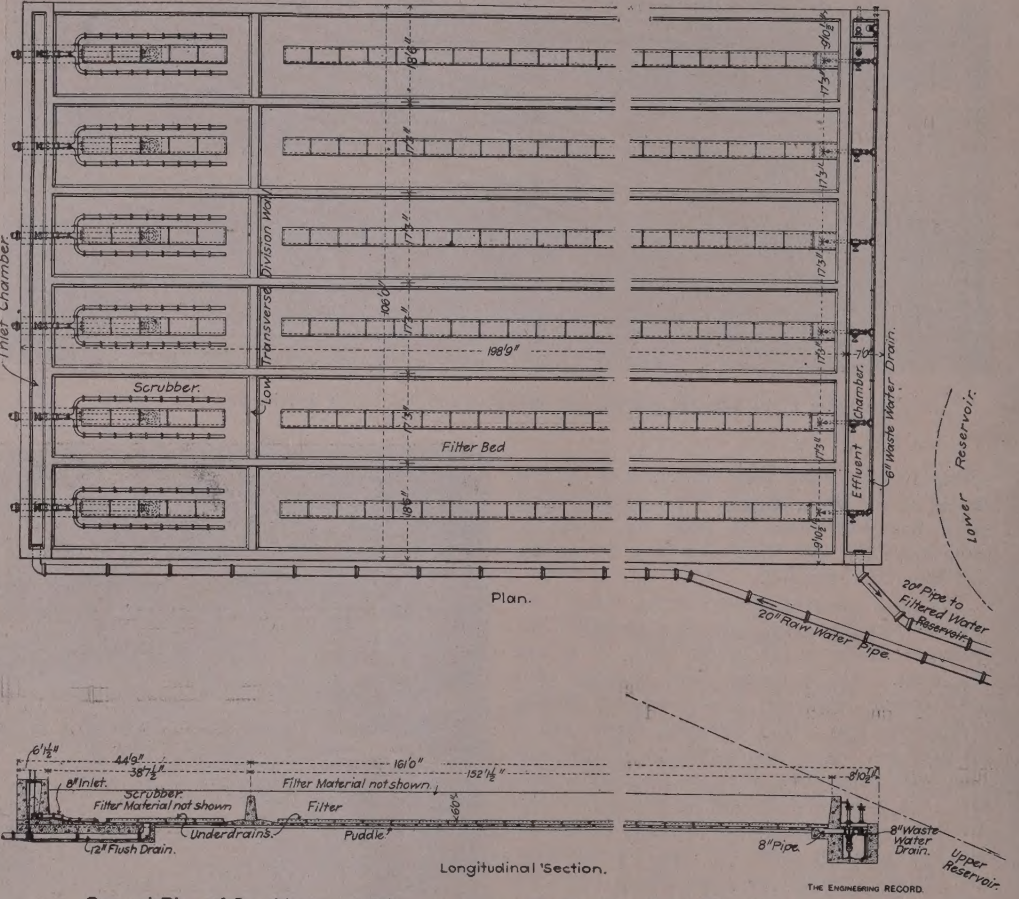
Nature of sample.	Bacteria.	B. coli.
Raw river water	3250	50.0
Water from storage reservoir..	2550	50.0
Effluent from scrubbers........	720	10.0
Effluent from sand filter.......	38	.2
Water from tap in town........	62	.2
Bacteria removed from river water by whole process, per cent		98.48
Bateria removed from river water by filters, per cent........		98.48

Samples collected May 10, 1905.

Table II.—Analyses of Raw and Filtered Water.

	River water.	Filtered water	
	Parts per million.	Parts per million.	Removal per cent.
Mineral solids	70.5	55.0	22.00
Organic solids	17.5	5.0	71.40
Total solids	88.0	60.0	31.26
Nitrogen as free amm.	0.031	0.007	99.00
Nitrogen as albuminoid ammonia	0.033	0.016	51.50
Nitrogen as nitrites...	trace	none	trace
Nitrogen as nitrates ..	0.76	0.59	22.30
Chlorine	2.54	2.54	none
Oxygen consumed	1.20	0.62	48.30
Hardness, cal'm carb...	45.00	32.50	27.80
Hardness, permanent ..	35.10	26.00	25.90
Hardness, temporary ..	9.90	6.50	34.34

The sample of raw water was taken from the river opposite the intake of the pumping plant at 10:30 A. M., January 17, 1905. The sample of filtered water was taken from a tap on the distribution system at 11 A. M., January 17, 1905. The percentage of removal is by subsidence in the reservoirs and by filtration.



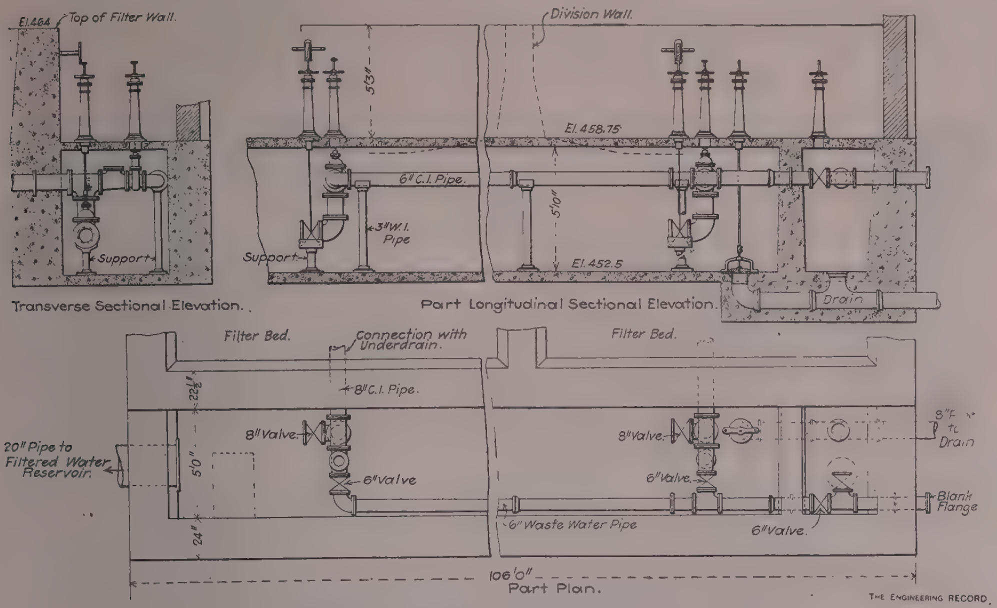
General Plan of Scrubbers and Filters and a Longitudinal Sectional Elevation through Them.

The scrubbers are designed to remove the greater part of the suspended matter in the water, thus requiring the sand beds to remove only the finest suspended matter and the bacteria. The scrubbers have, however, a bacterial efficiency of about 75 per cent. The preliminary filtration through the scrubbers has allowed the sand filters to be operated at a uniform rate of about 7,000,000 gal. per acre per day; the rate of operation of the scrubbers being at the same time about 28,000,000 gal. per acre per day.

The flow through the scrubbers is reversed about once in two weeks by closing the valve on the supply pipe and opening the valve on the waste-water drain. The water above the scrubber is thus passed down through the sponge and coke, washing out the greater part of the sediment that has been intercepted by them. This operation usually requires only a few minutes. The water over the scrubbers is more than sufficient to thoroughly flush the filtering material, although the water over each filter bed above the low wall separating it from its scrubber is also available.

Two revolving-drum laundry washing machines are installed to wash the sponge. These machines are mounted on a portable platform built over the I beams which hold the filtering material in place in the scrubbers. The platform is so arranged that it may be shifted transversely and longitudinally and thus placed close to the scrubber in which the sponge is being washed. The sponge is lifted directly to the machine by hand in baskets and when cleaned is returned to place in the scrubber in the same manner. The coke has not been washed and the sponge has been washed but once in 7½ months, which the plant has been in operation, the flushing of the scrubbers by reversing the flow through them keeping the materials comparatively free from sediment.

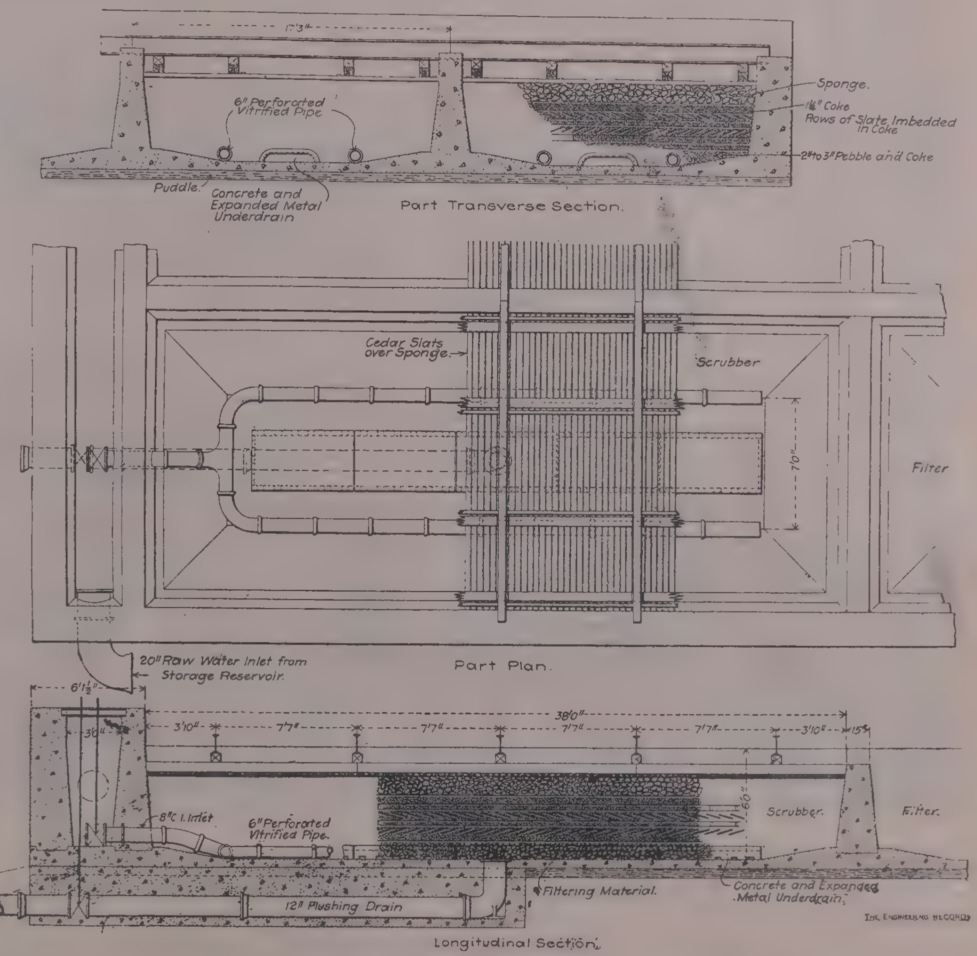
The larger size of materials used in the scrubber is considered to efficiently perform the service required of the scrubbers without becoming quickly clogged. It also permits the sediment removed from them to be easily flushed out with a small quantity of water under a head equal to that of the normal depth of water over the scrubbers. The arrangement of slates in the coke breaks up the direction of flow and prevents the water from following a course through a portion of the scrubber in which the material may happen to be laid more openly than over the remainder of it.



Details of Piping in the Effluent Chamber.

The filter beds were built long and narrow in order that unusual methods of scraping the sand beds and washing the dirty sand might be applied. The water is drawn down in a bed when it is to be scraped and the dirty sand removed with shovels by men standing on a timber platform suspended close to the sand on a traveling crane which moves longitudinally the length of the bed. The crane rests on two flanged wheels at each end of it which run on flat steel rails laid on timbers attached to top of the filter tank walls. The suspended platform is 15 ft. 10 in. long, and it is wide enough to provide room for about ½-yd. of sand and working space for two men. Sand scraping is started at the end of the filters farthest from the scrubbers and whatever depth of sand on the surface of the bed that is discolored by the culm and other sediment in the raw water which is too fine to be intercepted in the scrubbers, usually about 1½-in., is removed down to the clean sand. The dirty sand is loaded on the platform as it is scraped and when the platform is filled, it is moved to the sand washer at the rear of the bed over its scrubber.

The sand washer is built on a portable platform over the I beams of the scrubbers and may be shifted transversely from bed to bed. It consists of four bucket elevators, placed side by side, and a hopper, about 10 ft. high, 4 ft. wide and 10 ft. long, in which these elevators operate, with a trough at the bottom of the hopper where the washing operation takes place. The dirty sand is shoveled from the crane platform into a boot about 2 ft. high and taken up to the top of the hopper by the first elevator, which discharges it with a free fall of about 6 ft. into the wash water flowing through the trough at the bottom of the hopper. The second elevator is entirely within the hopper and merely elevates the sand to the top of the hopper and drops it back again into the water in the trough. The third elevator repeats the operation of the second. The fourth elevator is at the opposite end of the hopper from the first. It elevates the sand from the trough and discharges it on a chute at the front which leads to the suspended platform on the crane.



Details of Filtering Materials and Piping Connections of Scrubbers.

The wash water is introduced at the end of the hopper where the clean sand is being elevated and discharged by the fourth elevator. It flows through the trough at the bottom of the hopper and is discharged at the opposite end where the dirty sand is being discharged into the hopper by the first elevator. Water from the storage reservoir is used in washing and a 2-in. pipe under a head of about 20 ft. supplies abundant water for the operation. The sand falls into the water with considerable force and is thoroughly agitated each time it is dropped from the bucket elevators. The sediment that is washed from it is removed from the washer with the waste water. The outlet for the dirty water is so placed that none of the fine sand is carried away with it.

When the crane platform has been filled with clean sand from the washer, the crane is moved back to the rear of the filter and the sand restored to the bed. The men work on the platform in restoring the sand and distribute it with considerable care, placing it about 1 in. higher than the surface of the bed is to be left eventually. A hinged leveling board, which extends slightly below the framing of the platform, is attached to each side of it, and as soon as the load of sand has been distributed these leveling boards are dropped into place. The platform is attached to the crane by adjustable hangers with which it may be set at any height. It is adjusted at the desired depth of the sand bed by the hangers and the crane moved back and forth over the sand until the bed is perfectly level on top. The edges of the bed along the walls are carefully caulked with fine sand by a man walking along the top of the filter walls.

The cleaning of each bed, washing the dirty sand from it and replacing the clean sand on it requires three men, the regular attendant and two men from the maintenance force of the water company, about a day and a half under normal conditions. The sand washer is driven by a 5-h.p. National Electric Co. motor, which also supplies the power to drive the sponge washers and is the only power required in the operation of the plant. The crane is moved along the bed by a man at each end of it on the filter walls. The whole operation of scraping a bed and restoring the sand to it is done entirely from the crane platform. After the sand has been restored filtered water is slowly admitted through the underdrain from one of the adjacent filters. When the bed is filled water is turned on from the scrubber and the effluent permitted to waste for about a day.

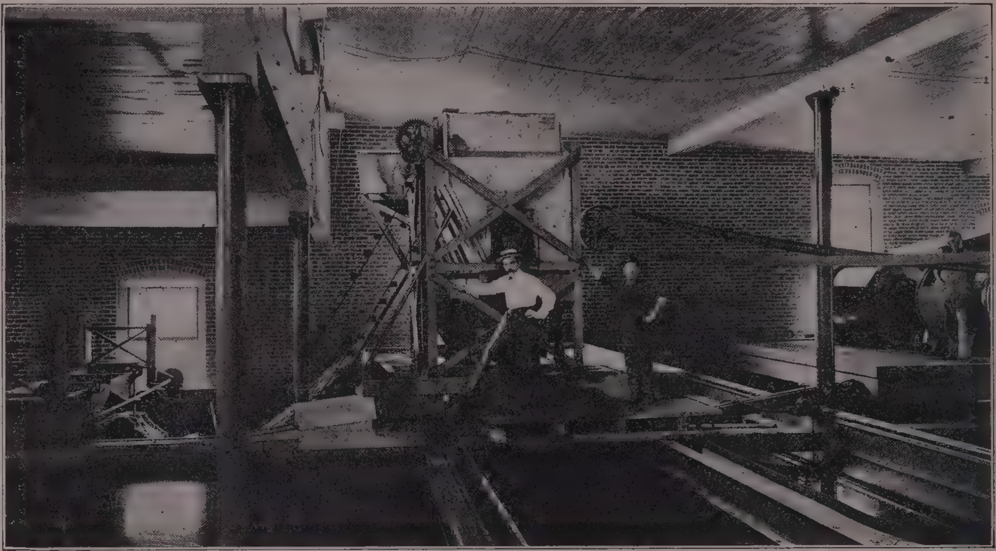
A membrane of asbestos fiber is being placed over each of the sand beds in order that the normal rate of 7,000,000 gal. per acre per day may be increased to 9,000,000 gal. per acre per day, without reducing the efficiency of the plant. The membrane is applied to the beds in an emulsion from a portable tank placed on the suspended crane platform. The sand bed is first covered with about 1½ in. of ⅛ to ¼-in. gravel and the membrane applied over that. The tank on the platform holds about 1,800 gal. of water; to this is added 100 lb. of finely divided asbestos fiber and the emulsion made of the water and fiber. The prepared emulsion is then applied over the gravel on the surface of the same bed from a perforated galvanized-iron distributing trough which extends the length of the tank and is connected to it by a pipe. About 2 ft. of water is left over the surface of the sand while the membrane is being distributed, and the tank and trough supported a few inches above the surface of the water.

The application of the asbestos, mixed and agitated in the water in the tank and then applied through the water over the sand, is easily accomplished and results in the formation of a uniform membrane over the layer of gravel on the surface of the sand. The membrane resembles wet blotting paper when in place and about 1⅓ lb. of fiber per sq. yd. is required to form a good covering. The layer of gravel separates the membrane from the sand so it may be removed without disturbing the gravel or sand when the water is drawn down. The air in suspension in the raw water is removed by the scrubbers so no difficulty is experienced from that source.

The regular operation of the plant requires the services of one man who formerly had charge of the reservoirs and who still operates them, besides running the filter plants. The sand beds are scraped when the head lost in passing water through them reaches about 4 ft., as indicated by a loss of head gauge on each filter. The beds have been scraped on an average about every 90 days. At the normal rate of operation this is equal to about 600,000,000 gal. per acre between scrapings.

The water in the open filtered-water reservoir is free from any traces of algae, although shortly after warm weather began in the spring a considerable growth took place in it. This growth continued a short time only, and is considered to have been caused by the spores which remained in the basin from the raw river water passed through it before the filter plant was built.

The plant was designed by Mr. P. A. Maignen, of Philadelphia, Pa. It was erected by Messrs. Harmer & Quinn, of Philadelphia, under the immediate direction of Mr. H. M. Ueberroth, superintendent of the Bethlehem City Water Co., and the general supervision of Mr. Maignen. Mr. M. P. Quinn is president of the Bethlehem City Water Co.



The Traveling Crane and Sand Washer in Position for Operation.

Interior of Filter Building from the Floor over the Inlet Chamber.

THE WORLD'S RAIL BUSINESS has been divided up by a "gentlemen's agreement," the newspapers report, by which American mills will be given exclusive possession of the American continents, in return for keeping out of all other fields.

Permeability Experiments, North Dike, Wachusett Reservoir.

One of the most important recent innovations in earth dam design is the dike construction at the Wachusett reservoir of the Metropolitan water-works. The work on the north dike was described in this journal on Jan. 20, 1900, and the south dike on Aug. 20 and 27, 1904. The feature of the design is the use in the dikes of fine soil stripped from the reservoir site and placed in very wide embankments. In the last report of Mr. F. P. Stearns, chief engineer of the Metropolitan Board, it is stated that measurements have been made during the past three years which give interesting and important information, confirming that previously obtained with regard to the impermeability of the soil which has been used for the construction of the greater portion of the north dike.

A small well was sunk on the down-stream slope of the dike, about 1,200 ft. distant from the crest of the dike and about 500 ft. from the toe. The surface of the dike at the well is about 25 ft. above the high-water level of a pond at the toe of the dike, and this pond is drawn down during the summer from 4 to 6 ft. below the high-water level.

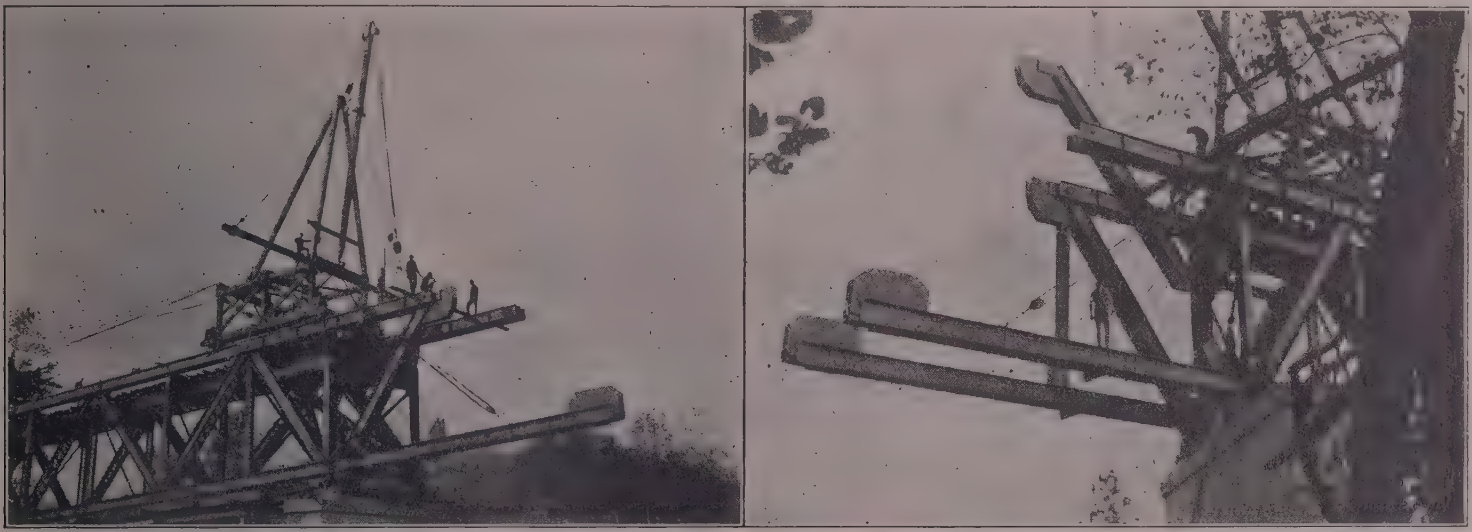
During the time of these observations the Wachusett reservoir had not been filled against the up-stream face of the dike, so that the water on that face was somewhat lower than at the down-stream toe. Notwithstanding this fact, the water in the well stands from 18 to 24 ft.—averaging about 22 ft.—higher than the pond.

The soil, although merely dumped from cars in layers 7½ ft. in thickness, is so nearly impervious that the rainfall alone is able to maintain the ground water in this portion of the dike only a few feet below the surface of the down-stream slope. The elevation of the water in the well rises after each heavy rain, and also shows a seasonal change, being higher after the spring floods and lower after the summer and autumn droughts. The water when highest was 2 ft. below the surface of the dike, and when lowest 7 ft. below.

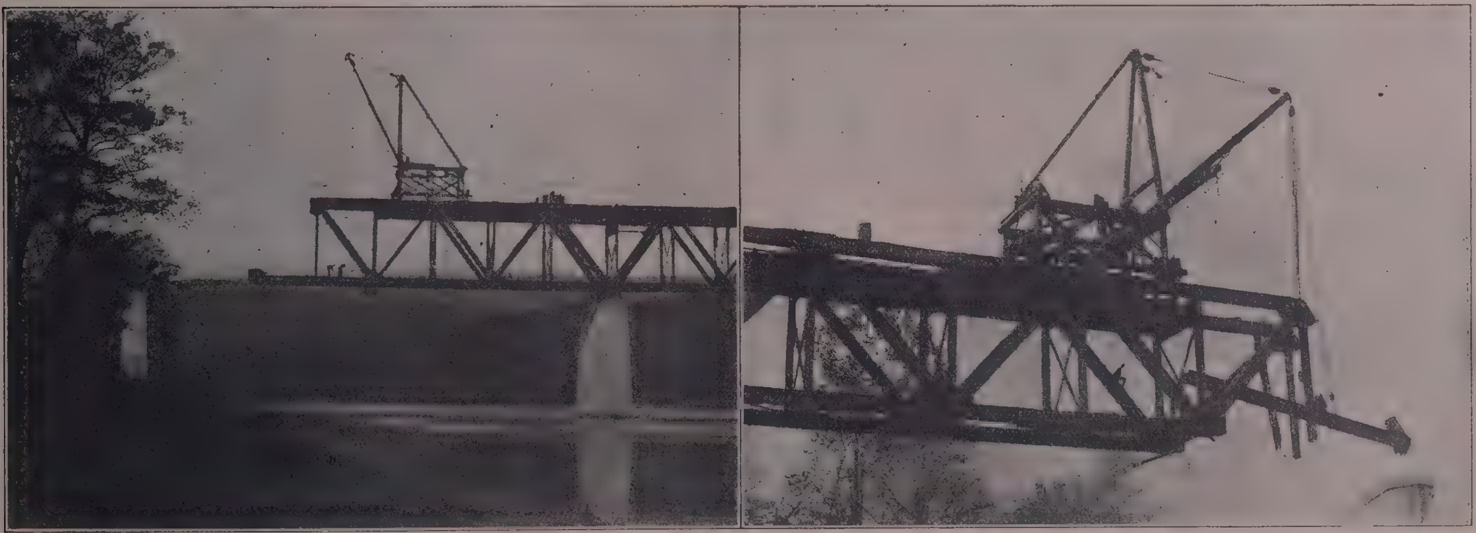
Not only were the observations made at the well, but on two occasions, Nov. 9, 1903, and April 21, 1904, were also made at points 25 ft. apart in each direction, covering an area 400 ft. long in the direction of the slope and 250 ft. at right angles thereto in the vicinity of the well. These observations showed that the ground water was from 3 to 7 ft. below the surface of the dike (which has a slope of from 3 to 4 ft. in 100) and approximately parallel with it.

Cantilever Erection of Simple Riveted Railroad Spans.

The construction of the 60-mile extension of the Western Maryland Railroad from Big Pool to Cumberland, along the crooked line of the Potomac River, involved much heavy and interesting construction work, as described in The Engineering Record of March 4, 11 and 18. For most of the way the railroad is adjacent to the Chesapeake & Ohio Canal, and there are so many curves and bends in the location that the road requires 18 separate bridge structures, some of them including a number of spans. There are, among them, nine crossings of the Potomac River, each of them from 382 to 1,367 ft. in length, and generally consisting of plate girder approach viaducts and long, plate girder and short, riveted truss spans. Nearly all of them are deck structures, with a maximum clearance of about 40 ft. above low water level, and they have a combined length of about 7,866 ft. of steel superstructure. The girder spans vary from 20 to 95½ ft. in length and the maximum truss span is 152 ft. 8 in. on centers of piers.



Assembling Lower Chords and Diagonals of Independent Riveted Truss Erected by Cantilever Method.



The Cantilever Erection of a Riveted Truss Independent Span.

Besides these crossings there are two bridges over the B. & O. R. R., four crossings over creeks and three separate crossings over the canal besides those included with the river crossings, all of them being of the same character as the river crossings. The substructures are all of concrete with footings in a few instances for the abutments on piles, but in all other cases on solid rock not far below low water level. Practically all substructures are built for two tracks, but the superstructures are all built for a single track and located in the positions which they will eventually occupy when the road is double-tracked and another line of single-track structure is erected adjacent to those already in position. The total weight of bridge steel for the line is about 7,000 tons and it was designed under the direction of Mr. Virgil P. Bogue, consulting and supervising engineer; Mr. J. Q. Barlow, chief engineer, and Mr. A. W. Buel, bridge engineer, in accordance with the standard specifications of the Western Maryland Railroad Company. The details and shop drawings were developed by the Pennsylvania Steel Co., which was the contractor for the superstructures.

The specifications provide for a live load of two 177½-ton consolidation locomotives, each with a 40-ft. wheel base, and 50,000 lb. on each of the driving axles, followed by a train load of 5,000 lb. per lin. ft. The allowance for wind pressure was practically 650 lb. per lin. ft. of loaded bridge, impact was included in the unit stresses, and, as much of the viaduct is on a curve, the usual allowance was made for stresses produced by centrifugal force.

All truss spans correspond to those of the third crossing and have riveted connections throughout and pin bearings at the ends and are divided into panels about 19 ft. long by vertical members and single diagonals. The deck trusses are uniformly 12½ ft. apart on centers with floor beams riveted to the vertical posts, so that their top flanges are just clear of the bottom flanges of the upper chords. Two lines of stringers 6½ ft. apart are web-connected to the floorbeams and have their bottom flanges riveted at intersections to the top lateral angle bracing. The lower chords are connected at panel points by horizontal transverse struts with I-shape cross-sections made with two pairs of angles, latticed, and the panels between them are X-braced by single angles. Each transverse panel between vertical posts is X-braced by pairs of angles, back to back, and similar bracing is provided between the inclined end posts. The ends of the sway braces are field-riveted to small, solid-web knee braces on the center lines of the vertical posts.

The track is carried over each pier on two panels of stringers reaching from hip to hip of the adjacent spans and intermediately supported a few inches eccentric from the pier center by a floorbeam connecting the upper ends of two vertical posts riveted to the bottom chord of one span and braced by horizontal struts to its end posts. The top and bottom chords are both made with pairs of 20-in. built channels latticed on both flanges and shop-riveted in two panel lengths. The field joints are located at alternate panel points in the top and bottom chords, at the points where the diagonal members intersect and the splices are made with the gusset web connection plates which are shipped loose and field-riveted to all members except at the ends where they are shop-riveted to the top chords at the hips and to the bottom chords at points Lo.

In addition to the gusset plates, the hip connections have 8-in. permanent pins and 7 15/16-in.

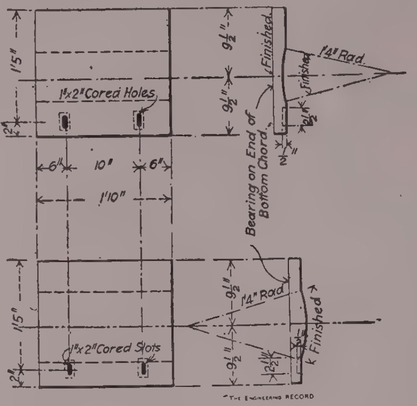
erection pins, which engage the top chords and end posts, but do not engage the diagonal or vertical members. The truss members are rivet-connected throughout, but the lower chord end gusset plates are continued below the lower chord bottom flanges and are reinforced there to form the webs of shoes which engage bearing pins through fixed and expansion pedestals. The webs of the pedestals are in the same planes as those of the shoes, and both of them have their reinforcement plates arranged so as to make opposite half-hole bearings for the pins and allow the side plates to overlap and have full-hole pin bearings, locking shoe and pedestal together.

The pedestal webs are stiffened by two pairs of vertical angles on each outside surface and by one pair of vertical angles on the inner surface, forming connections for the transverse diaphragm. The base plates of the expansion end pedestals are planed to form a longitudinal guide rib on each edge to retain the nest of rollers, and correspondingly planed bed plates are provided under the rollers. Where a fixed end and expansion end pedestal are supported on the same pier the fixed pedestal is made deeper than the expansion pedestal and its riveted base plate is extended longitudinally to form a bed plate for the rollers of the next span. The anchor bolts are clear of the longitudinal edges of the expansion pedestals and engage the base plates of the latter by means of horizontal clips projecting beyond the inner edges of cast-iron spacing blocks seated on the edges of the bed plates beyond the ends of the rollers. When the second track spans are erected the clips will be replaced by longer ones receiving the anchor bolts on their centers and engaging the base plates of both pedestals. The bed plates are not seated directly on the masonry, but for both fixed and expansion pedestals are set on grillages made with transverse I-beams 9 in. deep riveted together with short lengths of vertical 6-in. channels for separators. The anchor bolts pass through and between the beams and the interstices between the beam webs are filled with grout or cement mortar, but there are no top or bottom plates riveted to their flanges.

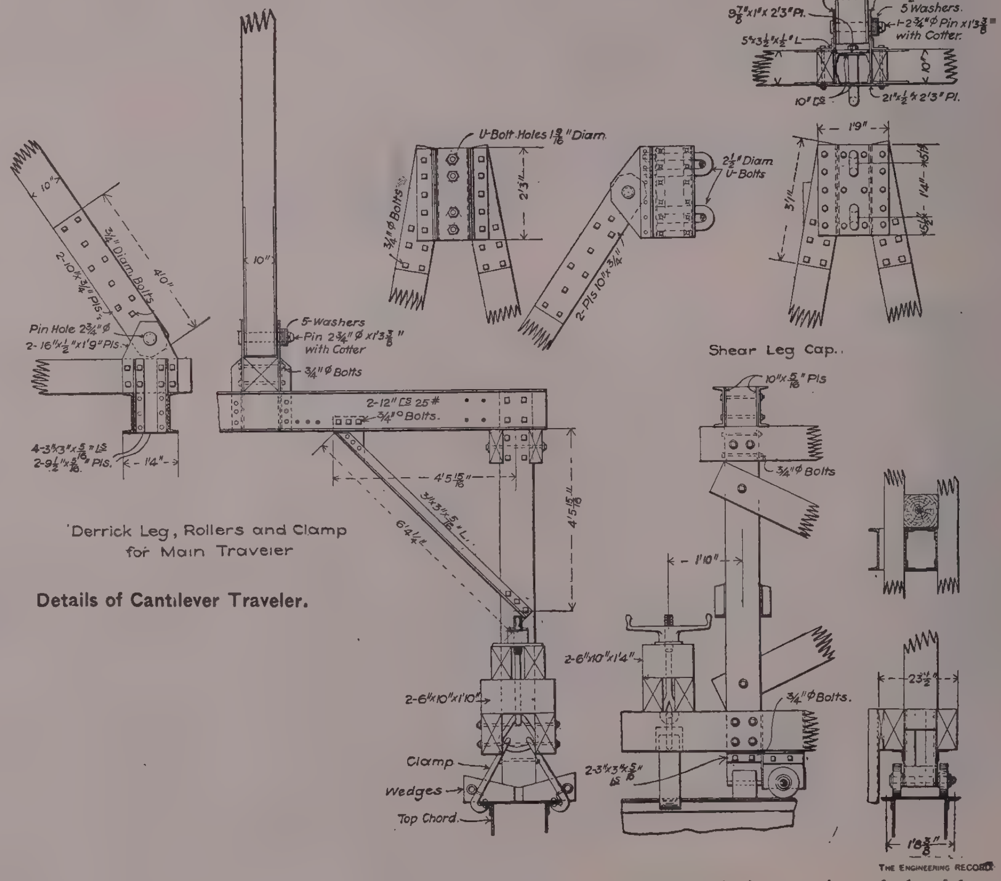
The end posts correspond to the top and bottom chords except that they have 24-in. cover plates. The diagonal members are made with pairs of built channels, latticed, and the vertical posts have I-shape cross-sections made with two pairs of angles, back to back, latticed. All of them have a depth just great enough to permit their flanges to be engaged between the connection plates riveted to the insides of the chord webs. At the shore ends of the shore spans short, vertical bents are riveted to the end lower chord connection plates and carry deep floorbeams supporting on their top flanges the ends of the approach girders with their top flanges flush with those of the stringers. The ends of the girders have brackets forming seats for the stringers in the end panels of the truss span.

Between Big Pool and Cumberland the Potomac River has a rocky bed and an ordinarily shallow channel and swift current in the narrow, crooked valley with steep banks. It is subject to many sudden floods of a maximum depth of about 35 ft. and a frequent depth of 20 ft. above low water, thus reaching nearly to the tops of the piers, which have been built to withstand the water and drift, and are believed to be secure against scour. It was not, however, considered safe to expose the superstructure during erection to these floods and means were provided to erect the ordinary truss spans by the cantilever method, although they are free spans in service. Their members were found to be strong enough to safely endure the increased temporary stresses due to erection, and the work was executed with a very simple plant and in a very rapid and successful manner, which is of special interest because it is a very rare example, if not the only one in this country where simple riveted trusses have been erected by the cantilever method.

The bridge, known as the third crossing, has three deck spans of 150 ft. c. c., with riveted trusses 25 ft. deep and 12½ ft. apart at a clear height of nearly 40 ft. above low water. All materials were delivered on canal boats and unloaded in the axis of the bridge about 150 ft. east of the east pier, by a standard 10-ton stiff-leg derrick with a 56-ft. boom seated on cribwork on the canal bank just clear of the tow path. The stiff legs were connected to the horizontal sills through steel jaw plates and the latter were supported on cribbing under the mast and on simple trestle bents at the outer extremities, where they were also counterweighted by old rails of sufficient weight to resist the maximum upward reaction, suspended near the surface of the ground in yokes made with vertical screw rods and horizontal wooden beams top and bottom, as shown in the detail.



Kicking Block B between Ends of Lower Chords.



'Derrick Leg, Rollers and Clamp for Main Traveler

Shear Leg Cap.

Details of Cantilever Traveler.

Anchorage for the overhanging arms during erection was secured by providing suitable connection to the last completed spans, reactions for the first span being provided for by temporarily erecting on shore falsework span No. 3, which served to balance span No. 1 and after span No. 2 was completed was taken down and finally erected in its permanent position. The method of erection is on the same general principles as the erection of the famous Atbara military bridge in the Soudan, which consisted of seven 150 ft. spans built and erected by American contractors for the British Government under conditions requiring such quickness of construction that foreign bidders could not compete successfully for the work. The Atbara work differed from that here described in the details. It was a pin-connected structure; it was designed for much lighter loads and the members weighed much less than those here described; the forward ends of the successive spans were temporarily supported above the pier tops and afterward lowered in harness to the pier masonry seats by hydraulic jacks; the steelwork was assembled with a different type of traveler and a large proportion of the erection work was done by natives under the direction of a few skilled Americans. This work was described in The Engineering Record of Nov. 4, 1899.

The derrick which unloaded the materials from the canal boats erected three panels of falsework on the canal bank and on it assembled an ordinary timber two-bent gantry traveler with inside vertical and horizontal clearances of 36 and 18 ft. The traveler contained about 5,000 ft. b. m. of timber and completed the erection of the falsework, which contained 23,000 ft. of timber and reached from the canal bank to the first bridge pier. On it the traveler erected in temporary position span No. 3, with the shore end of the trusses overhanging the shorter falsework by nearly 24 ft., 5 ft. more than one panel length, but at a height sufficient to clear the tow path.

This span was erected with all field connection holes filled with fitting-up bolts and its weight of about 350,000 lb. provided a moment of 26,250,000 ft.-lb., affording ample anchorage for the cantilever erection of the next span, although that resistance was increased by a load of about 50,000 lb., due to the engine, boiler, water tank, platform and additional rail counterweight, seated

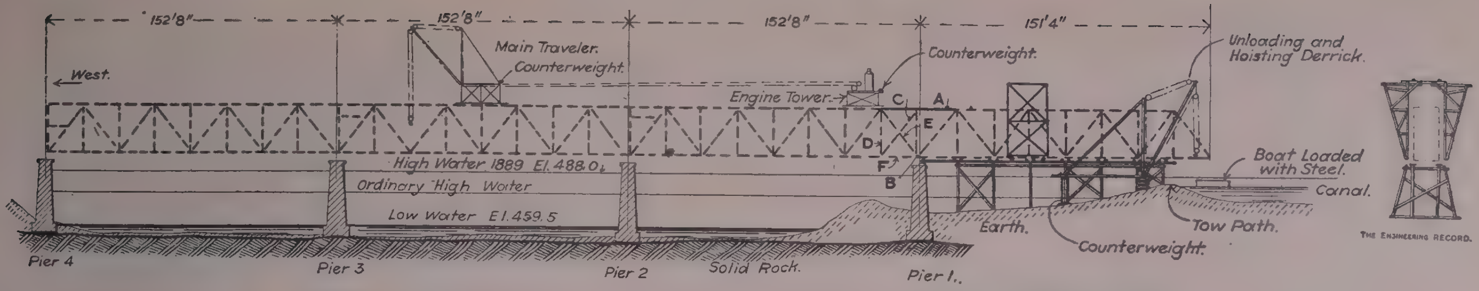
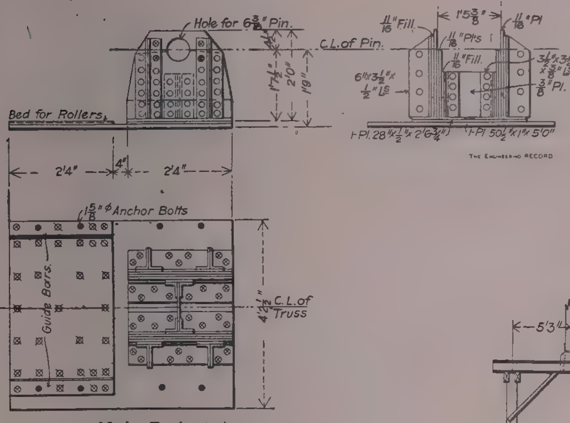
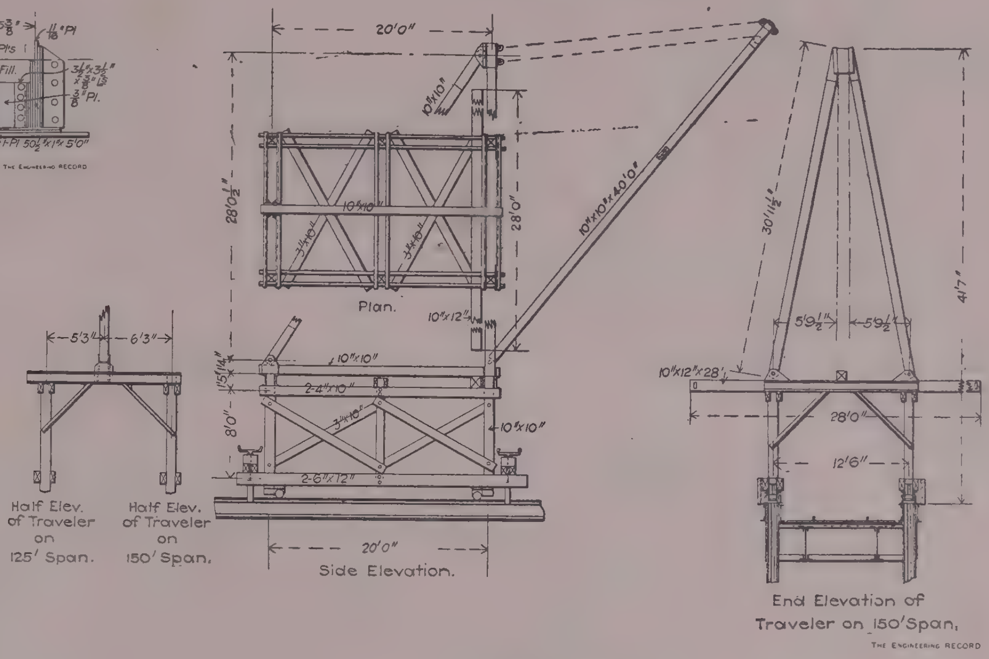


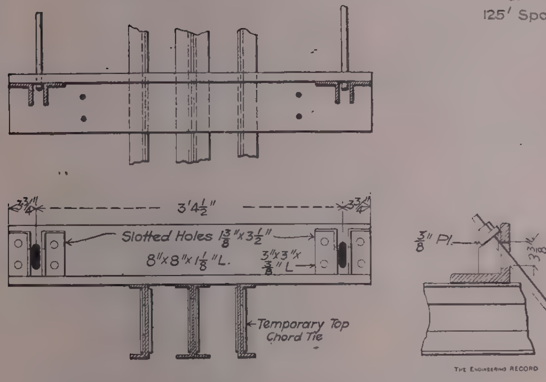
Diagram of Independent Spans and Temporary Anchor Span and Travelers for Cantilever Erection.



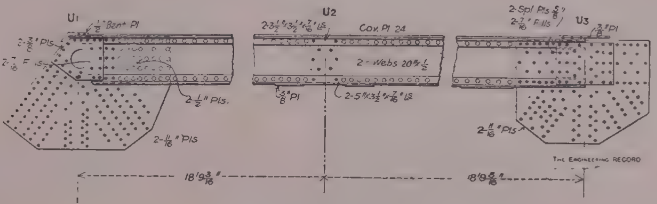
Main Pedestal.



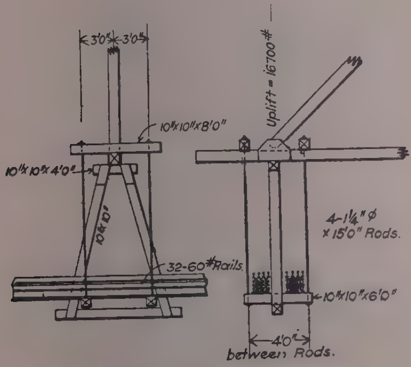
Cantilever Traveler.



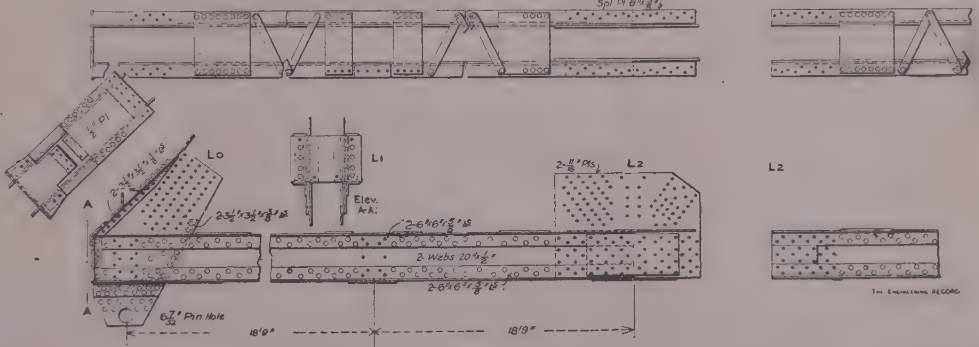
Connection for Temporary Reinforcement of Truss.



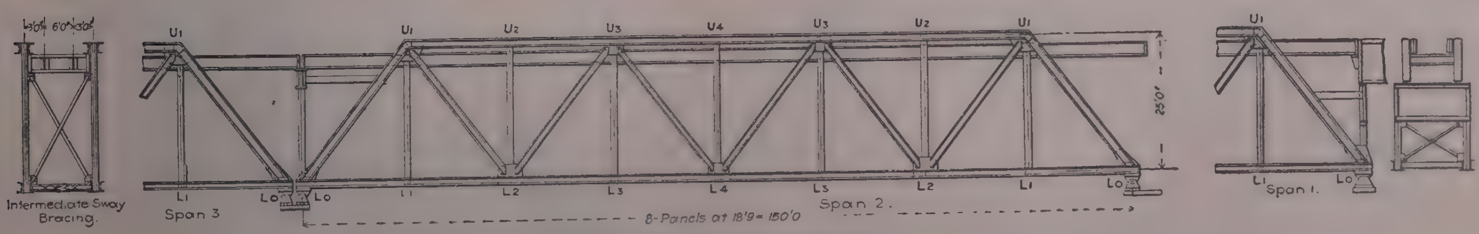
End Top Chord.



Derrick Anchorage.



End Lower Chord.



Elevation of Intermediate Span.

CONSTRUCTION AND ERECTION DETAILS OF THE THIRD CROSSING OF THE POTOMAC RIVER.

on the shore end of the top chord. The derrick assembled on the top chords of the temporary span the engine platform and the main traveler and the latter moved to the river end of the span and proceeded to erect the members of the first permanent span, which were unloaded and hoisted to the top of the temporary span by the boom-derrick and delivered by a material car on the standard gauge track laid on the regular stringers of span 3, and having clearance under both engine platform and traveler.

The engine platform was placed at the shore end of the temporary span and the main traveler was moved to the river end of the top chord, with its front wheels at the hip points of the trusses. It first assembled the stringer ties, A (shown by full lines in the position afterward occupied by the permanent stringers connecting the hip point and the approach span), and then set the kicking blocks, B, at the end of the bottom chord. The two-panel length of lower chords, F, were then assembled and temporarily supported from A by special erection ties, C, until the end post, E, and vertical, D, were assembled and connected, making the panel self-sustaining. The traveler then moved forward two panels and continued the erection of the trusses in the usual cantilever way until the next pier was reached and the end of the span seated on it, when the pieces A and B were disconnected from the shore span, moved forward and connected to the river end of the first span in corresponding positions and the operations as above described were repeated for the erection of the second and third spans.

During heavy winds the erection was discontinued and the traveler moved back off the spans. When in service the traveler was clamped to the superstructure at the foot of each post, and it was never advanced until all horizontal transverse bracing was assembled and connected as far as the trusses were assembled. Two-thirds of all open holes were filled with drift pins and the remainder with fitting-up bolts, which were all replaced by field rivets driven as soon as possible after the trusses were swung. The erection gang of about ten men was followed by four riveting gangs who drove the rivets with Cleveland Pneumatic Tool Co.'s hammers operated by air at about 100 lb. pressure from a Fairbanks-Morse gasoline air compressor seated on shore near one end of the bridge. The traveler and derricks were operated by Lidgerwood and Lambert hoisting engines.

The falsework under the shore span was made with framed bents having two vertical and two batter posts and a cap and a sill of 10x10-in. timber and carrying two lines of 12x12-in. stringers directly under the traveler rails and two lines of the same for the camber blocking. The 12½x16-ft. engine platform was supported on two vertical longitudinal two-post bents connected by overhead transverse struts so as to afford clearance between them for the material cars. The deck beams were laid across the upper horizontal timbers and cantilevered 3 ft. beyond the rear posts to receive the 15,400-lb. counterweight of old rails laid on them and secured by clamp yokes. The tower wheels were arranged, like those of the main traveler, at the feet of the vertical posts and sway bracing was provided outside transverse knee braces between the vertical posts and the cantilever extensions of the upper transverse caps.

The main traveler consisted essentially of a stiff-leg derrick seated on a platform somewhat similar to that for the hoisting engine, except that it had anchor clamps and was braced by inside instead of outside knee braces. The derrick had a 10x10-in., 40-ft. boom with two stiff-legs in the vertical transverse plane through the boom seat, and one stiff-leg in the vertical longitudinal plane through the same point. The stiff-legs were all made of 10x10-in. timber and pin-connected at the bottom to jaw plates on the horizontal timbers of the platform. At the tops they were reinforced by side plates and connected as shown in the detail, to a riveted box to which the shackles were attached for the tackles.

The wheels were 10 in. in diameter and had a 3½-in. face without flanges. They were set in riveted journal boxes which engaged the vertical posts and longitudinal double-sill timbers, as shown on the detail. They were clear of the feet of the posts so as to allow wedges to be driven under the latter to take the bearing and release the wheels when the traveler was lifting materials. They were spaced to just clear inside the rivets in the top chord, cover plates and short vertical angles were bolted to the sides of the traveler and projected below the top chord cover plates to serve as guides to prevent the traveler from running off the chords. The clamps were 2 in. thick and 8 in. wide and were provided at the lower ends with eye bolts for lines to lift them when disengaged from the chord flanges.

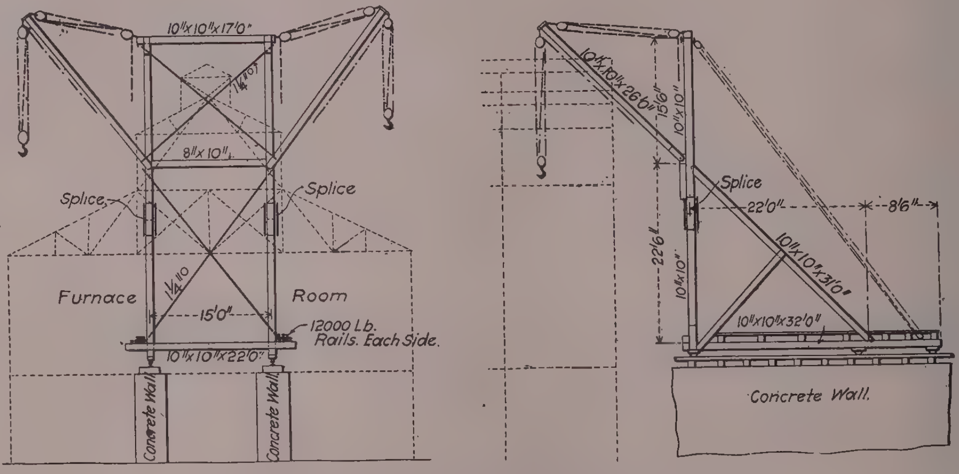
The three-web stringer ties, A, were each made with a pair of built channels and one built I-beam, all 20 in. deep and 40 ft. long on centers of 7 15/16-in. end pins. They were shipped separately and assembled together in the field with 20 transverse vertical diaphragms, bolted between their webs. Cover plates were also field-bolted across their top flanges and 4-ft. lengths of 8x8x1⅛-in. angles were bolted across them transversely to form seats for the temporary diagonal ties, C. The latter were pairs of 1-in. screw-end rods with turnbuckle adjustments. The kicking blocks, B, were flat steel castings with finished convex and concave bearing surfaces bolted to the vertical end surfaces of the lower chords to provide a ball-and-socket joint for the transmission of the erection compression stresses from the cantilever truss to the anchor truss and still allow for some adjustment of position and alignment without concentrating the pressure eccentrically.

Each of the 150-ft. spans weighs about 350,000 lb. and the heaviest piece handled in the field weighed about 12,000 lb. The three spans were erected by an average force of about 35 men in about ten working days, including riveting, painting and the time necessary to erect, remove and re-erect in its permanent position the span No. 3 used temporarily as an anchor span.

The bridges were designed in the office of Mr. V. P. Bogue, consulting engineer of the company. The contractor for the construction and erection of the bridges was the Pennsylvania Steel Co., Mr. J. V. W. Reynders, superintendent, and Mr. F. W. Cohen, engineer of erection of the bridge department. The successful erection of these spans is very satisfactory in that it demonstrates the practicability of erecting free riveted trusses by the cantilever method.

A Counterbalanced Roof Truss Traveler.

The furnace room of the New Jersey Zinc Co., at Hazard, Pa., has a double pitched roof supported on riveted roof trusses of 50-ft. span 14-ft. apart. These were riveted up complete at the bridge shops and shipped whole, loaded on two cars each, and were erected by a two-boom traveler moving backward away from the assembled framework on rails laid on top of the two walls of the casting pit in the center of the building. The traveler was of simple construction, containing 7,000 ft. b. m. of pine timber and 500 lb. of steel rods. It had a 25x32-ft. horizontal timber platform running on a 15-ft. gauge track and carrying on the front corners two 38-ft. vertical masts braced to the platform with longitudinal stiff-legs. Seats were bolted to the masts to receive the rounded heels of the 26-ft. booms, 22½ ft. above the platform. The masts were braced together transversely by upper and intermediate horizontal struts and diagonal rods, and their tops were guyed by four-part tackles to the rear of the platform. The transverse deck beams projected 30-in. beyond the masts on each side of the traveler to receive 12,000 lb. of old rail counterweights which, added to the weight of the traveler, gave it stability to handle the trusses several feet beyond the masts without anchoring the traveler. After each truss was erected it was lashed or braced to the traveler until the booms had erected the monitor truss and longitudinal members for that bay, thus bracing it securely. The traveler was operated by a Lidgerwood hoisting engine on its deck. The steelwork was built and erected by the Pennsylvania Steel Co., Mr. J. V. W. Reynders, superintendent of the Bridge and Construction Department; Mr. F. W. Cohen, engineer of erection.



Counterbalanced Traveler for Erecting Riveted Roof Trusses.

Tests of Very Cold Steel were described in a paper recently read before the Iron and Steel Institute by Mr. R. A. Hadfield. The test pieces, about 500 in number, were 0.18 in. in diameter, 2 in. long in the parallel part, and 3.2 in. over all. For the cold tests they were broken while immersed in liquid air, giving a temperature of —182° Cent. As a rule, the tests showed a large increase in strength and an equally marked decrease in ductility, although there were some important variations from the general rule. For example, a steel with 1.23 C. and 12.64 Mn. had a tenacity of 56 tons and an elongation of 30 per cent. at normal temperatures. In liquid air the tenacity was very little greater, although the elongation fell to 2½ per cent. As soon as the chilled specimens returned to the normal temperature their original tenacity and ductility were recovered. Some of the iron-nickel-manganese alloys showed comparatively little loss of ductility at the low temperature.

Proper Methods in Conducting Painting Tests.

A paper read before the American Society for Testing Materials by Gustave W. Thompson.

A number of years ago the president of our Society, Dr. Dudley, wrote a series of papers treating of the characteristics of paint and, we believe, for the first time in the history of the art, attempting some scientific understanding of paint problems. Not merely were these papers the first, in our opinion, that treated of the subject of paints scientifically, but it may be said that since that time practically no progress has been made along this line. It is to be deeply regretted that Dr. Dudley has not had time to enlighten the public further in this direction; for we are confident, had he been able to do so, the science of painting and paint manufacture would have been very much simplified. The situation, as it is presented today, is this: New paint materials are offered to the consumer from time to time, these paint materials having more or less value, but in regard to which the manufacturers, as a rule, claim a somewhat more universal merit than these paints in actual use would warrant. It is natural for the paint manufacturer to advocate the use of his product or products for every condition under the sun, because he hopes by this broad advocacy to increase their sale. If there is one principle, however, on which the members of this Society are pretty well agreed, it is that there is no complete paint which is suitable for all conditions of exposure; that is, every paint must, at least, have its various components put together in different proportions, according to the conditions of exposure to which it is to be subjected.

We believe that it is the business of the engineer to design the paint which he is going to use under any given conditions. We believe that the paint manufacturers are only too anxious to supply what the engineer may demand. If the engineer starts out to select a paint, his proper attitude is not to take any one of the prepared paints on the market and specify that because the manufacturer tells him it is the best for the purpose in question; but it is his duty to make such experiments as are practical for the purpose of finding out what paint is best for the conditions to which the paint surface is to be exposed. To examine a paint on a large scale is, of course, the most satisfactory way, provided the paint turns out well. We are unquestionably of the opinion that the surest proof of a paint is its use, just as we are confident that the best way to detect a poison is to take it internally. The unfortunate part of the matter is, however, that the use of paint in order to find its value may leave the user firmly convinced that this value is a negative quantity. Supposing that he is able to try a paint in a limited way on full-size structures, and the result, while not a minus result, is really very near that—that is to say, suppose the result leaves him somewhat in doubt—how is he going to tell whether the fault lay in the paint or its method of application? How can he be sure that the relative failure of the paint may not have been due to inherent destructive conditions external to the paint itself, but peculiar to the structure painted? A painting test of this kind, properly called a "field test," is of inestimable value when accompanied by tests conducted under conditions all of which are known. These are what may be called "laboratory tests," and, if conducted with care and parallel to field tests, they act as a check upon the results obtained by these field tests and give a better basis on which to rest scientific conclusions. These laboratory painting tests, made with the intent of exposure under service conditions, should be supplemented by other laboratory tests which should parallel information enabling the engineer or paint chemist to determine the relative value of a given paint in advance of the results which are obtained by field or laboratory tests under service conditions. We must not reverse this order, however, and attempt to substitute purely chemical tests for exposure tests under service conditions until the laboratory tests have demonstrated their value.

By the term "painting tests" in our title we have intended to include those tests which can be conducted with scientific accuracy, but which at the same time are as close as possible to ordinary practice so long as this accuracy is not impaired. Unfortunately, tests supposedly of this kind are in most cases without value. So much is this the case that laboratory painting tests are often spoken of in words of derision, as though they could be made to produce any result desired by the skillful manipulator of the brush. In most cases, these painting tests are made by persons interested in exploiting certain products, whereas they should be conducted principally by the consumer. The primary cause for the lack of value which these painting tests usually show is that they are not conducted with sufficient accuracy. Tests of this kind should be conducted under the supervision of a competent engineer or chemist and with as much care as if a chemical analysis were being made.

Committee E, of the Society, has outlined a method of conducting painting tests for protective coatings, this method demanding proper attention to all those details which are essential to the attainment of accurate results. These tests, when carried out by the sub-committee having them in charge, should prove of inestimable value. There are other paints, however, which, though "protective," are used for the purpose of producing a desired finish of appearance. Most paints are of this kind, and I propose, with your permission, to say a few words about painting tests made, using this class of paints.

Let us, to start with, take the question of the relative "covering power" of paints. To my mind, the term "covering power" has only one proper meaning; that is, the power to hide the surface painted. It is, as Dr. Dudley has pointed out, a function, first, of the light-destroying or absorbing power of the constituents of a paint, and, second, of the difference in refractive index between the pigment and vehicle. Whatever it may be caused by, however, we are more interested in the actual facts of the case than in the reasons therefor. In comparing two paints for covering power, it is generally understood that these two paints should have practically the same color and be very nearly alike in tone, for the eye is not able to note accurately the difference in covering which exists between paints of different colors or tones. When we compare two paints of the same color and tone for covering power our work is somewhat simplified when it is borne in mind that very few paints are homogeneous as regards pigment. Most paints contain several pigments, the principal one being a white pigment of some kind. Only with straight white or dark colors is the pigment likely to be homogeneous. Furthermore, with the colored paints consisting largely of white pigment, the tinting material is so fine that only a very small amount is usually needed to give the tint desired. In this case, the actual covering power of the paint is principally dependent upon the white pigment present. Our greatest interest, therefore, centers around the covering power of white paints; for, when we wish to design a paint of a certain color, we usually select a given white paint and add to it such coloring materials as have the highest possible tinting power and of which consequently we have to add the least amount possible. The result is that, practically speaking, tests for covering power are demanded for white paints only, and it is of these that I desire to speak.

On the threshold of our inquiry we are confronted by two difficulties. The first of these has to do with the amount of vehicle we are to use to get the "consistency proper for painting." In the present state of the art there is apparently no method for determining this consistency; the consistency proper for painting is simply a matter of rule of thumb. There is nothing standard about this consistency; it may be one thing in winter, another in summer; one thing with a flat brush, another with a round brush, and still another with the squirt gun. We have a refuge, however, and that, it seems to me, is the only safe one. When we have mixed our paint to a "consistency proper," in our opinion, "for painting," let us record the formula on which we prepared the paint and let our report state this formula in full detail. If the paint was a prepared or ready-mixed paint, then the analysis of the paint should also be reported in as nearly formula form as possible. In other words, we may have difficulty in determining what is the consistency proper for painting, but we need have no difficulty in recording the composition of the mixture which was used in making a given test for covering power, and this, in the present state of the art, is all that we can ask.

The second difficulty which presents itself is in the adoption of a spreading rate per gallon of paint. There can in practice, of course, be no standard spreading rate, and yet we have found that any white paint which has, according to our experience, a consistency proper for painting can be readily brushed out so as to cover 1,200 sq. ft. to the gallon of paint when applied to a fairly smooth surface, and in most cases, if it is not spread out at that rate, the paint will run. We solve this difficulty of the spreading rate at which the paint is to be applied in the same way that we solve the difficulty in connection with the consistency proper for painting; that is, we simply make the spreading rate followed a matter of record.

To illustrate, let us suppose that we have received two paints which we desire to compare for covering power; these paints, we will say, are prepared paints—that is, they have been thinned to a "consistency proper," in the manufacturer's opinion, "for general painting." We would, first of all, analyze these paints to determine the formula on which they were prepared. Inasmuch as the pigments in the two paints may vary in composition and, consequently, in specific gravity, we make a determination of the weight per gallon of paint as received, and, knowing the percentage by weight of the vehicle present, we calculate the percentages by volume of vehicle and pigment present, which gives us a somewhat better conception as to the nature of the paints. All the information we have thus obtained is recorded. Our next step would be to compare these two paints as to the relative ease with which they can be spread over the same area, without any particular regard to their covering power. If we find that they can be spread over the same amount of surface without, as is usual, great difficulty, we adopt a standard spreading rate for the two paints—say, 1,200 sq. ft. to the gallon, one coat—and apply the paints to standard prepared surfaces at that rate, and when we are through we compare the paints for their covering power or power to hide the surfaces painted. Now let us compare this method of making a painting test for the covering power of white paints with the method usually followed. Jones has a paint that he wants tested. He takes it to his friend Brown, the painter, and wants his opinion. Brown reports in a few days that the paint he received from Jones covered better than any paint he had ever used. Now, Brown may have been perfectly honest in making this report to Jones, but unless the formula on which the paint was mixed and the rate at which it was spread is given, Brown's opinion is worse than useless.

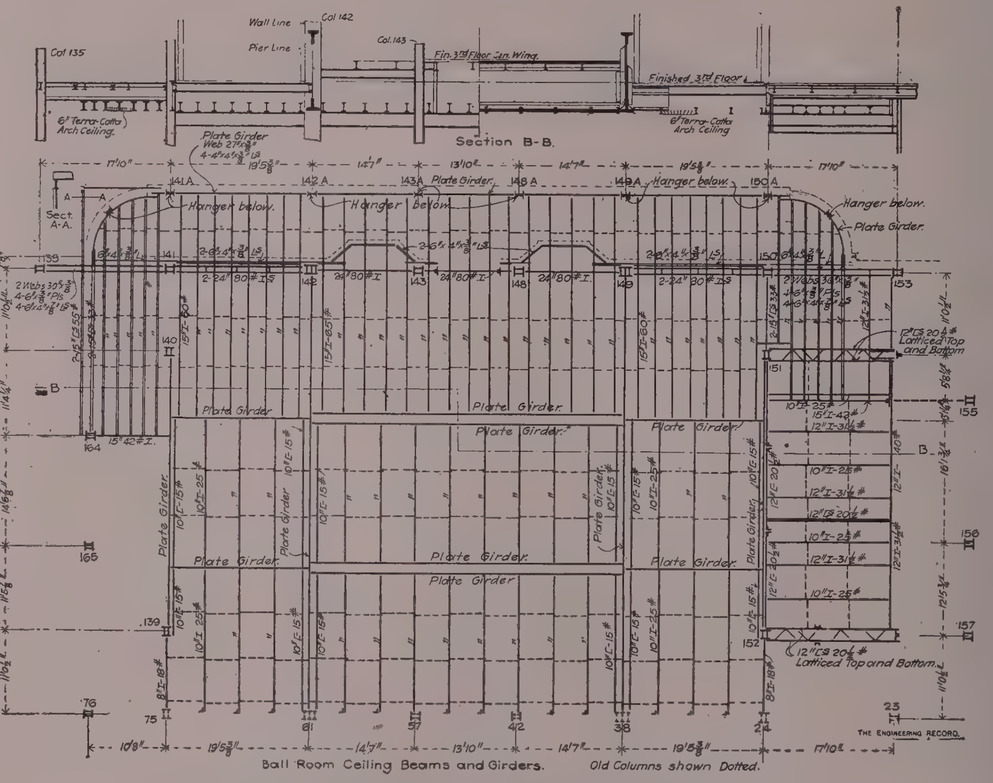
We describe here more in detail our method of comparing white paints for covering power: Use white pine boards, 30 in. long by 10 in. wide and approximately 1 in. thick. Each end of the board is provided with a cleat having a tongue fitting into a groove on the end of the board and securely nailed on. The entire board, including the cleats, is to be finished to the size given above. Three of these boards are primed with, we will say, the following paint mixture: White lead paste, 100 lb.; linseed oil, one-third boiled, 75 lb. No attempt is made to secure a definite amount of priming paint to the unit of surface; this for the reason that the boards may vary considerably in their absorptive power. When this priming coat is dry each board receives a diagonal stripe of lampblack in japan about 1 in. wide on one or both sides of the board, as may be desired. When this black stripe is dry it is given a second coat of paint mixed to a consistency proper for painting, the formula being recorded. The weight per gallon of the paint so mixed is then obtained by finding its specific gravity and multiplying by 8.33, which gives the weight per gallon. Inasmuch as the board which we are using has a total surface of 680 sq. in., all we have to do is to find what the ratio is between 780 sq. in. and the spreading rate at which we desire to apply the paint in order to find the fraction of the gallon which we wish to apply to each board. If the rate adopted is 1,200 sq. ft. to the gallon, then we get the formula: 680 sq. in. : 1,200 sq. ft. :: 1 : x, the reciprocal of x being the fraction of a gallon of paint to be applied to each board, one coat. Having the weight of the paint per gallon, we easily get the amount of paint by weight to apply to each board, one coat on all sides. When this second coat of paint is thoroughly dry a similar coat is applied, and when dry the boards can be compared for the covering power of the paints on them. We mention the painting of three boards with each paint to be compared; the purpose of this is that variations in results are obtained between boards which are apparently painted in an identical manner. These variations are not great, but it is thought best to eliminate them, to a certain extent, by painting three boards and selecting the one giving medium results for comparison with boards painted with other paints.

Tests conducted along these lines, we believe, will give valuable and scientific results and will enable the intelligent person to draw safe conclusions.

Let me state here, by way of illustration of the usefulness of this method, one of the results obtained by tests comparing pure white lead and linseed oil with a mixture of white lead and a small amount of barytes with linseed oil. The pure white lead was mixed on the formula of 100 lb. of white lead paste to 30 lb. of linseed oil. Two mixtures containing barytes were made on the same formula as the white lead and pure linseed oil, except that to the pure white lead was added an amount of barytes corresponding to 10 per cent. by volume of the white lead present, and the amount of oil was also increased 10 per cent., so that the mixed paint contained in each case the same percentage of pigment by volume and the same amount of oil by volume. Another mixture was made, adding 20 per cent. by volume of barytes to the sample of white lead paint and a corresponding amount of oil. These three paints were then compared by the above method for covering power and spread at the uniform rate of 1,200 sq. ft. to the gallon. The result was that both paints containing barytes showed a very perceptible diminution in covering power. Now, this illustration has not for its purpose the saying of anything in favor of white lead and against barytes, but simply to show that if the statement is made that a small percentage of barytes can be added to white lead without impairing its covering power some explanation must be made as to the method by which such a result is obtained. If in any painter's hands the result has been found that the addition of a small percentage of barytes did not impair the covering power of the white lead, it must have been due either to the fact that less oil was used or that less surface was covered per gallon of the paint containing barytes than by the straight white lead.

Perhaps the most important test that can be applied to paints is a durability test; that is, a test as to the permanency of the paint film itself. Boards painted, as in the making of the covering power tests described above, can be exposed to the weather and the durability of the paint films observed. Durability tests, to be of value, should be conducted with the same care as the covering power tests. The formulas on which the paints were mixed should be recorded, also the rate per gallon at which they were spread.

Quite recently painting tests with a view to observing the durability of various paints were reported on to the International Association of Master Painters and Decorators, and the results obtained were published generally in the paint journals. Undoubtedly, these tests were conducted conscientiously and the conclusions reported give honest opinions about the results obtained. We feel, however, compelled to question these results for several reasons which appear very important. In the first place, single boards only were painted with each paint and exposed. At least three boards should have been painted and exposed alongside of each other, and the board which showed results about the average of the three should have been selected for comparison with other paints similarly selected. Very frequently it will be found that two boards painted apparently in the same manner and with the same paint will show differences in results due to differences in the boards themselves. In the second place, the formulas on which the paints were mixed are not stated with sufficient detail. In the third place, there is no information given as to the spreading rate at which the respective paints were applied. Considering any two of the boards, the paint on one board may have been twice as thick as on the other, for all we know to the contrary. We have very little doubt that the thicker the paint film, the greater its durability. This emphasizes the importance of having painting tests conducted under the supervision of the engineer or chemist. The ordinary master painter is, we believe, thoroughly competent to interpret results and to conduct field tests on full-size structures, but when it comes to preparing boards for exposure special training is required, such as the chemist or engineer only can be said to have.



Framing Arrangement in Ball Room Ceiling, Bellevue-Stratford Hotel.

To conclude, no matter what the painting test may be, whether it be of colored paints or white paints, whether it be with homogeneous or mixed pigments, whether it be for covering power or durability, the essential features that we should insist upon are that the formula of the paint should be stated fully; that the thickness of the film, or what is the same thing, the rate at which the paint is spread, should also be stated. These two requisites of proper painting tests should also be demanded in all tests for the permeability of paint films or their permanency, no matter how these tests may be applied. If we wish to compare two paint films for their permeability by the dextrine test, we should know, to start with, that these two films have approximately the same thickness. It is a safe assumption that the thicker the paint film, the less its permeability. If we desire to compare two paint films for their permanency, we should know that these two paint films are of the same thickness, as the elasticity and general life of the film are proportionate to its power of resistance to oxidizing influences, and the thicker the film, the more permanent are its inner parts.

Highway Improvements so planned as to result in interstate or trunk-line roads have been taken under consideration by the Springfield, Mass., Automobile Club. It is proposed to secure the co-operation of all interested in such work in the vicinity, and to carry on a well-considered system of agitation which will demonstrate to similar clubs elsewhere the strong influence and valuable co-operation for proper road construction that can be secured by good organization.

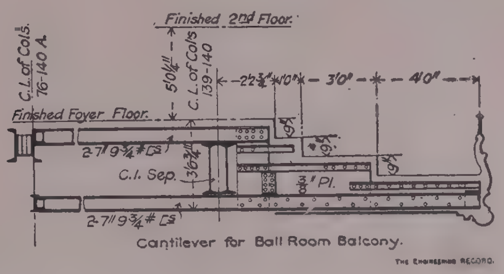
Heavy Plate Girders in the Bellevue-Stratford Hotel Extension.

The Bellevue-Stratford Hotel, at Broad and Walnut Sts., Philadelphia, is a comparatively new steel cage building to which there has just been added a 77x184-ft. 16-story extension, the first and second stories of which contain a large ballroom communicating with the old portion of the building. In order to secure an unobstructed 60x80-ft. floor area in this room the thirteen stories above are carried on a system of massive plate girders, which are supported partly by the new columns and partly by the old columns, thus involving some difficulties and requiring great care in the design and erection. A lighter construction could of course have been secured by carrying the upper story columns on deep trusses, extending through one or even two stories in partition walls, but this was prohibited by architectural requirements, and the supports were designed to be mainly located in waste space between the ballroom ceiling and the third floor.

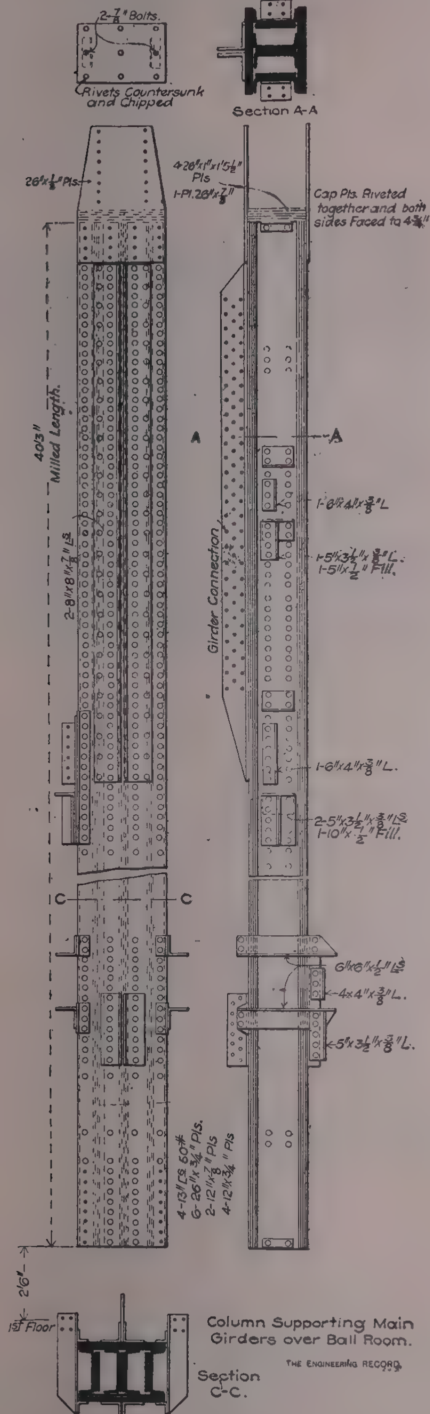
The ballroom is two stories high and has a balcony extending around all four sides and supported by transverse cantilever plate girders with fulcrums and anchorages on the second floor beams as indicated in the cross-section. The ceiling is from 4 to 6 ft. below the third floor and is carried by 10-in. and 15-in. I-beams supported by a system of long and deep plate girders arranged as indicated in the diagram, where each one is shown by a single heavy line. The main girders extend from old column 38 to new column 149 and from old column 61 to new column 142. They are duplicates and are about 56½ ft. long, 11 ft. deep over all, and weigh about 81,000 lb. each, thus being among the heaviest ever placed in a building. Each girder has an estimated total load of 1,857,000 lb. and is web-connected to the column at each end by 80 1-in. turned bolts in quadruple shear. The multiple shear on the bolts was secured by engaging the girder web between two connection angles on the columns, and then adding an outside splice plate over each angle flange. The bolt holes were reamed to 15/16 in. through templates made for the column connections, and after the girder was erected in the building and the column connections entered, the holes were reamed to 1 in. and the bolts driven in.

The two new columns which support one end of these girders are of massive construction with closed rectangular cross-sections made with three webs and built up of plates and channels. Their connections for other beams and girders are all made with top and bottom flange horizontal angles and single vertical web connection angles. At the upper end a horizontal diaphragm, 4¾ in. thick made of several plates countersunk riveted together, is inserted between the end of this column and the foot of the third story column to distribute the load of the latter over the large cross-sectional area of the former.

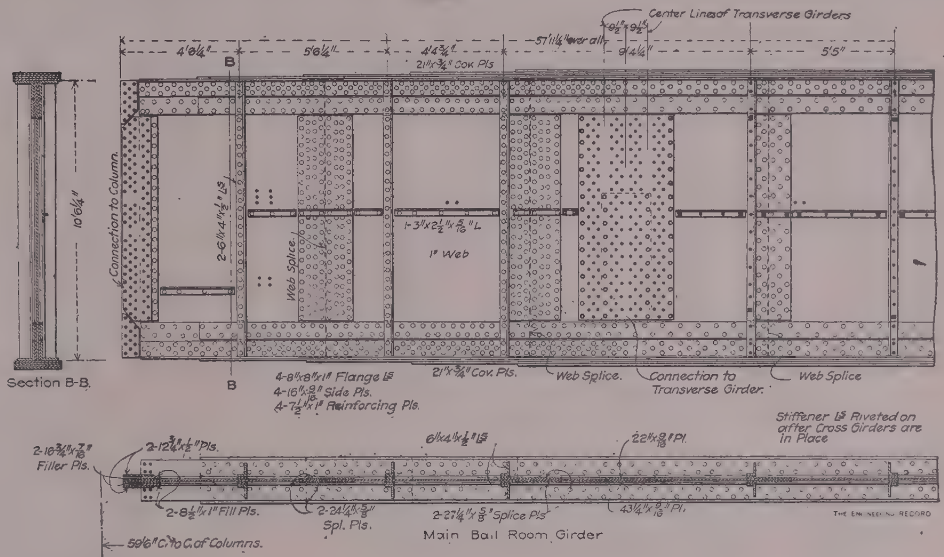
The large girders are connected together by two pairs of transverse plate girders nearly 43 ft. long and 6½ ft. deep, each pair of which carries two 13-story columns. The web is ¾ in. thick throughout and is made in two pieces, stiffened under the column seats by two pairs of vertical fillered angles, which, like the other web stiffener angles, are fillered and ground to fit at the ends. The girders are used in pairs, securing the advantages of box girders and developing the required strength without involving the excessive weights of double web girders or the difficulties of handling and riveting them. The webs of each pair are 19 in. apart and are connected at four points by riveted transverse vertical diaphragms. Hand holes 4½ in. in diameter are made through the webs near the vertical rows of diaphragm connection rivets to provide for the field riveting, and



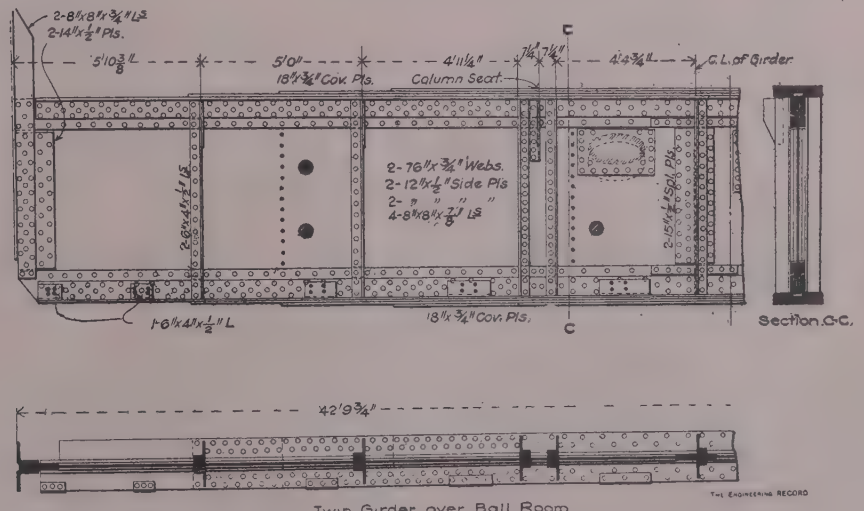
Cantilever for Ball Room Balcony.



Column Supporting Main Girders over Ball Room.



Main Ball Room Girder



Twin Girder over Ball Room

Ball Room Girders and Columns Carrying Upper Stories.

in each girder there is, through the upper part of the web, an oval manhole, 22 in. long, to give access to the space between the girders. The web around the manhole is reinforced by a ½-in. plate on each side. Each end of the girder is web-connected to the main girder by 92 ⅞-in. field-driven rivets in six rows through the 8x8x¾-in. end vertical angles which project 3 ft. above the top flanges so as to distribute the load over the full depth of the main girder web. The 9/16-in. filler plate is countersunk riveted to the main girder web, so that it could be fitted on at the shops and shipped in place. The end connection angles are set ⅜ in. beyond the ends of the web so that there is no danger of the latter touching the main girder webs and the bottom flanges are coped to clear the flange of the main girder with which they are flush on the bottom. Each of the twin girders weighs about 34,000 lb., and, like the large girders, is essentially symmetrical about the center line.

The largest girders were transported from the railroad to the hotel on a special 50-ft. truck weighing 10 tons and drawn by 32 horses harnessed four abreast. The distance was not very many blocks, but the time required was nearly eight hours, and two horses were exhausted and had to be replaced before the work was accomplished. At the site the girders were unloaded from the trucks by hydraulic jacks and cribbing and were rolled into the building at ground level and then hoisted to position by tackles suspended from heavy framed bents erected for that purpose.

Messrs. G. W. & W. D. Hewitt were the architects of the building, Messrs. Purdy & Henderson were the structural engineers, the George A. Fuller Co. was the general contractor and the structural steel was fabricated at the Pencoyd plant of the American Bridge Co.

Mechanical filtration of the water supply of Troy, N. Y., where the typhoid fever rate is very high, is recommended by Messrs. W. P. Mason, S. M. Gray and G. W. Fuller. The plant should have, they say, an available filtering surface of 5,040 sq. ft., a 600,000-gal. coagulating basin, and a two-basin 5,000,000-gal. covered filtered water reservoir. This plant will have a nominal capacity of 15,000,000 gal. but will be able to operate at a 20,000,000-gal. daily rate for a short time. Its estimated cost is $168,000.

The Water-Works at Raton, N. M.

The city water works and the tank of the Atchison, Topeka & Santa Fe Ry., at Raton, New Mexico, were formerly supplied with water from a 35,000,000 gal. storage reservoir formed by an earth dam built across a canyon 7¾ miles from Raton. A second earth dam, which develops a 65,000,000 gal. reservoir, has been built about 3 miles above the first one to store sufficient water for the increased demands of Raton and of the railway. An 8-in. iron pipe conveyed water from the old dam to the tank and the distributing system in Raton, but this pipe had become so corroded that the capacity was reduced to that of a 6-in. pipe, so a 12-in. wood stave pipe line has been laid from the old dam to supplement the capacity of the iron pipe.

The old dam is in New Mexico, while the new one is in Colorado, with its crest over 8,400 ft. above sea level. The new dam is 545 ft. long and 20 ft. wide at the crest, with a maximum bottom width of 230 ft. and a maximum height of 55 ft. With the exception of about 80 ft. of irregular concrete wall near the middle, it is built entirely of sub-soil and clay, rolled and puddled in layers. The up-stream face is on a slope of 1 to 3, rip-rapped with heavy stone, excavated in the immediate vicinity, while the down-stream face is on a slope of 1½ to 1. The site of the dam was first roughly cleared and trenches 5 ft. wide and 3 ft. deep excavated across the site and filled with well rolled clay puddle to cut off the flow of ground water, which was quite heavy through part of the site. These trenches were dug perpendicular to the direction of the ground water flow and are not all parallel to the center line of the dam, and for the most part are not at the center of the dam, although well within both up-stream and down-stream toes. The material in the dam was borrowed from pits at the site, which were first stripped of the top soil by wheel scrapers. It was placed in layers of 6-in. to 1 ft. in thickness with the scrapers and puddled as it was placed.

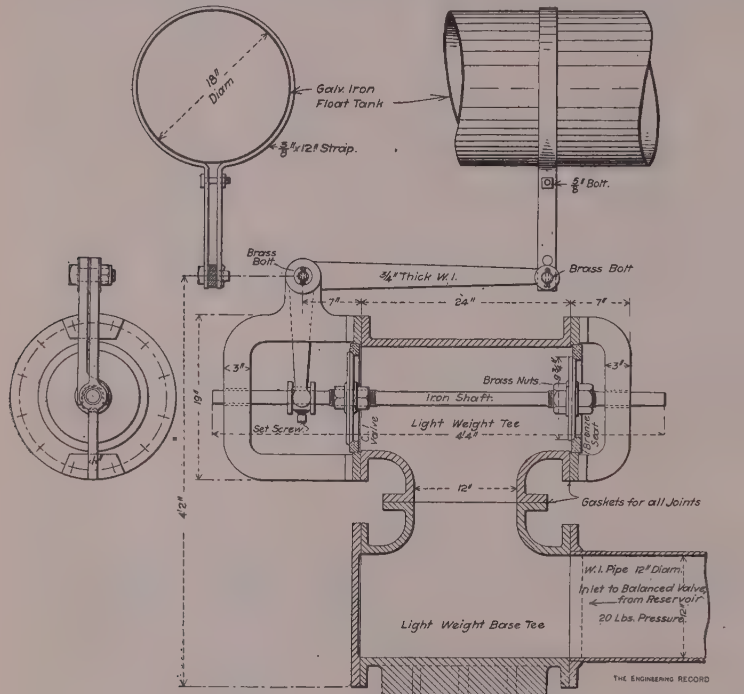
The water supply is largely from springs, as the rainfall is light and quite irregular. When the rain does come, it is frequently very heavy and a spill-way 60 ft. wide, with its bottom 5 ft. below the crest of the dam, was excavated around one end of the dam to carry the surplus water from a watershed of 29½ sq. miles above the dam. The dam was filled thirty days after it was completed and after a year's service, no leaks or apparent weakness have developed.

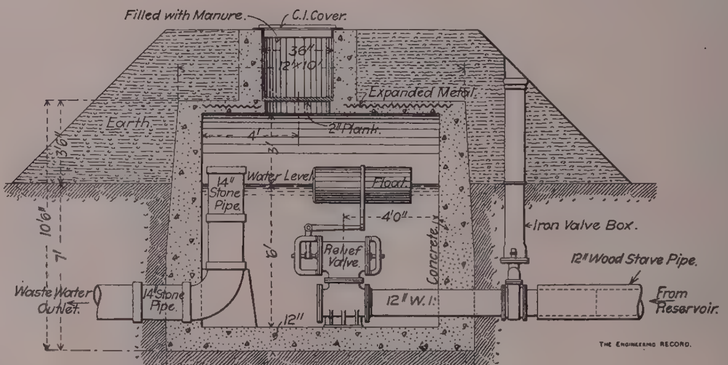
The outlet from the dam is a 16-in. cast-iron pipe, 260 ft. long, laid through the bottom of the dam near the middle. The intake of this pipe is an open 5 x 5 x 3 ft. concrete wall, covered with an iron grating. The flow is controlled by a gate valve in a 5 x 5 x 5 ft. gate chamber at the lower end of the pipe in the down-stream toe of the dam. The pipe is laid in a concrete casing about 3 ft. square, which is reinforced about every 36 ft. with a concrete collar 5 ft. square and 1 ft. thick. Water flows from the end of the outlet pipe for 3 miles through the natural channel of a creek which is of such firm material that there is no perceptible loss from percolation and as the gate is only opened at night, the loss from evaporation at the high altitude is slight.

The 12-in. wood-stave pipe line is 35,000 ft. long and the difference in elevation between its upper end at the old dam and its lower end near the railway station at Raton, is 458 ft. Several relief chambers have been built in the line to keep the pressure below 130 lb., which pressure the wood-stave pipe is considered to be capable of withstanding with safety. The details of one of the relief chambers are shown in an accompanying illustration.

The pipe was furnished by the Pacific Coast Pipe Co. and the Phillips Construction Co. The new dam was designed by Mr. H. C. Phillips, as engineer of the western grand division of the Atchison, Topeka and Santa Fe Ry., and was constructed under the supervision of Mr. F. M. Bisbee, who succeeded Mr. Phillips.

Laying Wood Stave Pipe Line.





General Arrangement of Relief Chamber on Wood Stave Pipe Line and Details of Valve in It.

The American Society of Municipal Improvements has planned an excellent convention in Montreal on Sept. 5-9, equally noteworthy for exhibits and papers.

District Heating.

For a number of years the commercial practicability of district heating in connection with electric lighting was regarded as very questionable by most engineers. Little by little, however, actual experience has shown that this is a profitable service when the power plant is located near a well-built part of a city. Where the station is a mile or more from the heart of the town, such heating is generally out of the question. This subject has lately been investigated with much care by Messrs. W. H. Blood, Jr., R. S. Wallace and C. R. Maunsell, who have reported some important data regarding it to the National Electric Light Association

An element of extreme importance, they point out, is the relation of the cost of steam coal to that of domestic coal. In cities where steam coal costs from $1 to $2 and domestic coal runs from $4 to $9, the company has much in its favor, and should be able to make rates that are at once attractive to the public and profitable to itself. With forty companies that report that they are doing a satisfactory business, the average price of steam coal is $2.18, while the average price of domestic coal is $5.74. Among these same companies, where the hardest conditions exist, steam coal is quoted at $1.17 and domestic coal at $1.50. On the other hand, one company reports that it pays but $4 for steam coal, whereas domestic coal costs $10 per ton.

The length of the season is a factor to be considered, especially when heat is furnished on any flat rate system, i. e., per square foot of radiating surface per season, per cubic foot contents per season, etc. When on a meter basis, however, the length of the season is of much less importance. It is well to avoid, in general, the making of contracts requiring heat during the summer months.

USE OF HEAT, DETERMINED BY METERS.

Class of Service.	Condensation per Sq. Ft. of Radiation per Day. Av.	Max.	Min.	Condensation per 1,000 Cu. Ft. of Space Heated per Day. Av.	Max.	Min.	Ratio Cu. Ft. Space to Sq. Ft. Radiation.	Av. Temp. ° F.
Residences	3.83	5.20	1.79	51.3	75.2	27.4	76	34°
"	2.49	2.49	2.49	34.6	34.6	34.6	72	44°
"	1.69	3.22	0.54	....	....	....	...	....
Stores	4.48	10.1	1.01	29.0	50.2	11.4	115	34°
"	2.61	4.03	1.18	17.1	37.0	9.2	181	44°
"	1.94	3.77	0.64	....	....	....	...	....
"	2.32	3.4	1.8	20.0	28.5	13.6	136	40.5°
Offices	5.02	7.94	2.13	51.5	78.0	24.9	81	34°
"	2.92	3.70	1.73	25.1	32.2	19.7	120	44°
"	1.56	1.83	1.19	26.0	30.4	19.8	60	43.5°
"	2.27	3.62	0.89	....	....	....	...	....
"	2.97	3.8	1.8	29.0	49.7	14.9	111	40.5°

NOTE.—While there is a large variation between maximum and minimum, it was found when making the tabulation that most of the figures ran very close to the averages given above.

What to do with his exhaust steam is a question for the manager to decide. Which is best: To install condensers and thereby increase the efficiency of the engines 20 per cent or more, and the capacity as well; or to sell this by-product as it is, in the form of heat? If the rates obtainable are fair, that is, if the heat can be sold nearly on a live steam basis, the plant should receive from the latter course at least three-quarters of the original value of the steam; while a condensing outfit would save but one-quarter to one-third of its value. If water for condensing is not available, the argument for district heating is strengthened. Very many plants have short and sharp winter peak loads; and it would seem that under such conditions their managers might be warranted in installing some inexpensive, simple, non-condensing engines, the exhaust from which would be well utilized for heating purposes; or it might even prove to be best, under proper conditions of load and fuel costs, to install condensing apparatus which would be run during the summer, but which in the heating season would be cut out, the exhaust steam being then utilized on the heating system. The use of exhaust steam for heating will necessitate the carrying of some back pressure on the engines, thereby reducing both capacity and efficiency, a point not to be lost sight of.

Before making the investment, the manager desires to know what income he may expect and how many square feet of radiation his exhaust steam will care for. Knowing the pounds of water per horse-power per hour consumed by his engines, and referring to his load curve of the previous winter, he can readily figure the minimum amount of exhaust steam that can be counted on for any single hour, and this should be the basis of his figures. Now come certain deductions: feed-water heaters and station leakage will probably take 15 per cent., while losses in mains and services may be as much more, though on the latter point we can cite one plant where the losses are less than 3 per cent.

The returns that the committee obtained from steam-heating plants indicate that it is safe to figure for ordinary conditions about 0.20 lb. of water per hour per square foot of radiation (varying from 0.05 to 0.50). As all the consumers are not using the steam at the same time, particularly if on a meter basis, the load factor should be no more neglected than in the lighting business. Naturally, with the heating business this is higher; and if the figure of 85 per cent. is used it will probably be on the safe side.

Together with the above must be figured the interest charges on the total underground installation and that portion of the central station plant which is used for heating purposes; and lastly—depreciation—an item that is often neglected but which should nevertheless be estimated. From the best evidence at hand the last item seems to be about 5 per cent. per annum on the total cost of the investment.

Though it is generally considered good practice to limit the heating business to that which can be taken care of by the exhaust steam, in many cases live steam has to be supplied at certain times in order to give good service. Where this condition exists and the demand on the live steam increases, it soon becomes necessary to set aside or to install a boiler solely for this purpose. Then comes the turning point of the plant. The chances are that it is selling live steam on an exhaust steam basis, and it soon becomes evident, if the question is investigated, that there is no profit in the business. This condition of affairs has occurred repeatedly and in many cases has both cut down the net earnings of the company and given the heating business a bad name.

If the heating business is to stand upon its own merits, it is unwise to go into it on any other basis than that of live steam. If, however, it is the intention to supply heat where so doing secures good consumers of electricity and for the express purpose of getting such consumers, it brings up entirely different considerations. In this connection it is well to note that the heat required for buildings that might be consumers of both electricity and heat, is so great that even if all the exhaust steam of the entire plant were utilized for them there still might be a deficiency; in other words, the ordinary building requires more steam to heat it than to light it. It therefore behooves the careful manager to direct the growth of business on the heating system in the direction that will bring the greatest number of good consumers of electricity, and to this end all extensions of mains should be carefully considered, remembering that the supply of heat is limited. It naturally follows that the necessity for soliciting or advertising the heating business alone seldom exists after the first or second season.

It is advisable to limit the service connections made in street mains to the fewest possible, making extensions, wherever practicable, from service pipes in adjacent buildings, with due regard, however, for the capacity of the service from which the extension is made. For this and other reasons it is essential that all service pipes, extensions of same and service valves should be laid and owned by the central station.

Theoretically, a meter rate is the only equitable method of charging, but practically it may be found that a flat rate will answer the purpose fully as well. The previous failures to produce a reliable meter had until recently prevented the general adoption of this system of charging, but from the success of the past year with new meters, and with the assurance from the manufacturers of still further improvements, it is probable that the meter basis of charging will become more popular.

When electricity is sold on a flat rate basis the consumer invariably leaves lights burning at times when they are not needed, simply because it adds somewhat to his comfort, for generally speaking too much light is impossible. On the other hand, too much heat is nearly as bad as too little, and the consumer naturally takes pains to shut off the steam when the room begins to be uncomfortable. Although there is a wide difference of opinion in regard to the amount of light required for proper illumination, it is generally conceded that the temperature of a room should not be far above or below 75° F. This would seem to form a strong argument in favor of a flat rate system.

If a flat rate is established, it is necessary to decide whether the rate shall be based on the square feet of radiation installed, or on the cubic feet of space, or on the equivalent cubic feet of space heated, which latter case takes into consideration windows, doors, masonry walls, etc.

Numerous formulas have been worked out to give approximately the number of square feet of radiation that should be installed to heat various sized rooms under different conditions of service. It stands to reason however, that the quantity of steam used to heat given spaces under similar conditions will be approximately constant and independent of the amount of radiation installed, provided that enough or more than enough radiation is supplied to take care of the coldest days. This would appear to be an argument in favor of basing the flat rate on the number of cubic feet or equivalent cubic feet of space heated.

The table shows that the steam consumption, as would be expected, is greatest where the average temperature is lowest and that this is an important factor to be considered in arriving at the rate to charge; that the kind of service makes very little difference in the steam consumption, although residences seem to have a greater condensation per cubic foot of contents and a less per square foot of radiation than either stores or offices; that the results, although varying widely, are near enough to justify the establishment of a flat rate, this being on the assumption that customers will use practically the same amount of steam whether on a flat or meter rate; and, finally, that if a meter rate is established a corresponding flat rate would vary according to the length of the season and average temperature, and may be easily approximated from the figures given. These are the opinions of Messrs. Blood and Wallace. Mr. Maunsell is opposed to any system of flat rate charging, and states that he feels safe in making the statement that his flat rate customers (in Topeka, Kansas) use one-third more steam than customers similarly equipped paying by meter.

The consumer should provide and maintain in good repair, the report states, an approved steam trap of sufficient capacity to properly drain the condensation from the heating system of his building without any loss of steam. This steam trap must be provided with an automatic air valve and a gate valve must be placed in the inlet pipe so that the steam may be cut off for repairs and examination, as occasion arises. There should also be a ground joint union in both inlet and outlet pipes near the trap. The trap must be so located that it will discharge by gravity into the cooling coil and with at least 6-in. head above the highest point in the coil or outlet from same.

The consumer should provide and connect to the outlet pipe of the steam trap a continuous cast-iron cooling coil, to be approved by the company, the surface of which must equal one-fifth of the radiation supplied with steam. This cooling coil must be connected as an indirect radiator, properly encased in galvanized iron and supplied with cold air in an approved manner, the heated air being carried to some part of the building where a constant supply of heat is required. The cold air ducts must be provided with dampers and by-passes for use when steam is shut off. The cold air ducts of cooling coils should have at least one square inch area and the hot air ducts at least one and one-quarter inches area of cross-section for each square foot of cooling coil connected. Register faces must have a net area equal to that of the duct in which they are set. The pipe supplying condensation to the cooling coil must enter the coil at the highest point, and leave it at the bottom, and then be carried up above the cooling coil, but no higher than trap discharge, so that the cooling coil will at all times remain filled with water. The coil should be supported on a substantial iron pipe frame. The purpose of the cooling coil is to extract all the available heat from the condensation. It is an economy for the consumer, for it utilizes heat that would otherwise be wasted. Steam must not be shut off unless proper precautions are taken to prevent freezing the cooling coils. Where a supply of heat is required in the basement, and conditions permit the installation, cast-iron hot water radiation is recommended in preference to cooling coils.

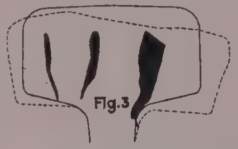
The Baker's Hill Tunnel on the Louisville & Nashville R. R., which has been very difficult to drive, will probably be finished in 2 months.

Some Causes of Failure of Rails in Service.

A paper read before the American Society for Testing Materials by Robert Job, Chemist, Philadelphia & Reading Railway Company.

For a number of years a careful study of causes of rail failures has been made by the Philadelphia & Reading Ry. The method followed has been in the case of each failure to forward a portion of the rail showing the defective condition to the Test Department with a form giving information regarding manufacture and service of the rail. An investigation then followed to determine the cause of the failure.

In a general way it may be said that when failure occurs owing to fracture, excessively rapid rate of wear under given conditions, or crushing down in track, the poor service is generally due to one or more of the following causes, viz.: (1) Pipes in the steel, (2) presence of a considerable proportion of blowholes, (3) excessive segregation, (4) coarse granular structure, (5) rough handling.



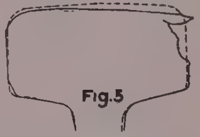


Fig. 3, Contour of Fig. 4, 5 Months Use.
Fig. 5, Contour of Fig. 6, 2 Months Use.

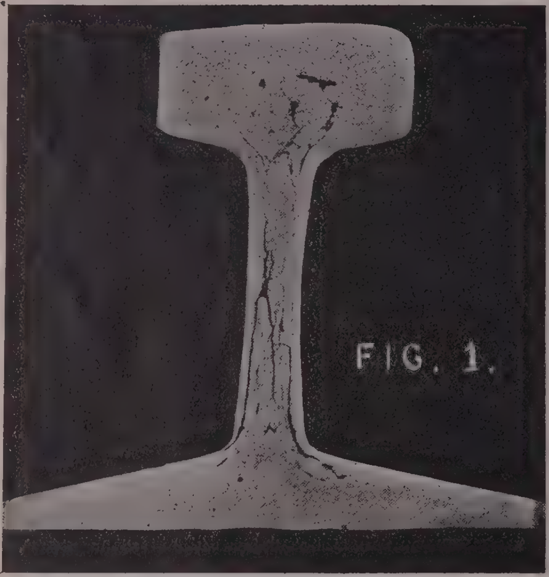


FIG. 1.

Polished Section Showing Piping.

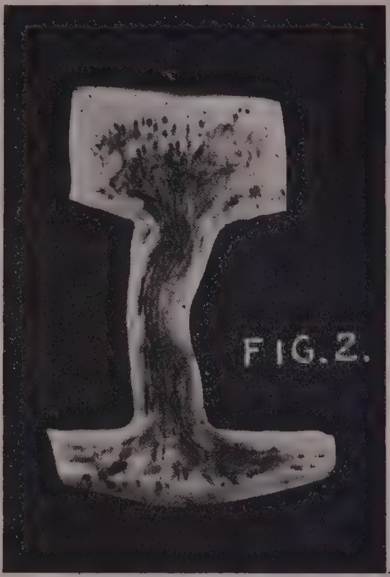


FIG. 2.

Wing Rail of Unsound Steel.

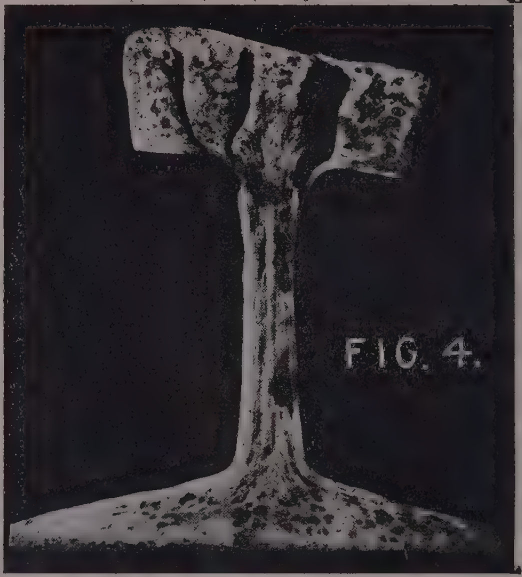


FIG. 4.

Unsound Rail After 5 Months Service.

In the first case the defect is readily shown by the appearance of the fractured end with its unwelded surfaces, and upon buffing off a section of the rail, the extent of the pipe is generally clearly shown, even without etching, as in Fig. 1. In such case the steel is in a seamy condition, and the layers readily split apart or crush down upon comparatively slight pressure, and indication of the unsoundness is usually given after a very short service. This general type is caused by failure at the mill to crop ingots down to sound steel, and such a rail is nearly always derived from metal from the top of an ingot, and almost invariably fails when tested under the drop test. When the mill inspection is watched closely and when it is seen that the test butt for the drop test is always taken from the top of the ingot, failures due to such pipes are relatively rare.

A defect of this character is one of the most dangerous which can be present, since it is liable to result in sudden crushing under light pressure, and consequently it should be guarded against most carefully at the inspection.

The second cause of failure, viz.: Presence of a considerable proportion of blowholes in the steel, is probably the most common defect under present mill practice and the one which causes the largest number of failures in service today.

Such rails do not fracture after a very short service unless the extent of the blowholes is very pronounced, but the defects are generally noticed by the gradual mashing down of portions of the rail, accompanied generally by flowing over at the sides of the head, and the track men are apt to complain that the rail in question is "too soft," or that it has numerous "soft spots."

Analysis proves, however, that the metal is not softer than that in other rails adjoining the defective one, but, upon polishing and etching the section lightly with iodin or other medium, it will be found that the steel is unsound, or in other words, that blowholes, slag and other foreign matter have prevented thorough welding of the steel and have resulted in a number of seams which break up the solidity of the metal and permit a slipping apart of the unwelded surfaces under moderate pressure, causing final fracture or crushing. In some cases this condition is caused by presence of slag and of oxides in the steel, but in the greater number of instances it is simply due to blowholes, and relatively little slag or oxide is present.

Fig. 2 represents the heel of a wing rail of a frog of the following analysis: Carbon, 0.63 per cent.; phosphorus, 0.137; sulphur, 0.078; manganese, 0.874. This rail crushed down in service upon another road into the condition shown, in less than five weeks.

Figs. 3 and 4 represent a batch of rails which mashed down in a few months upon another road to the contour represented by the dotted line. The unbroken line represents the template, and the large black areas indicate holes in the steel which were formed by the elongation of the metal upon the top of the rail when the failure began.

When this section was polished there was no indication of an actual pipe, but upon light etching the cause of the weakness is very evident, showing that the steel is so thoroughly unsound and porous that rapid crushing was possible. The composition of this rail was: Carbon, 0.82 per cent.; phosphorus, 0.102; manganese, 0.88; sulphur, 0.053, and the heat average was: Carbon, 0.59; phosphorus, 0.075; sulphur, 0.074; manganese, 1.06.

It is thus seen that a marked segregation was present as well as great unsoundness, and it is evident that the cropping at the mill had been insufficient to get to sound and reasonably homogeneous metal. These rails were furnished under the mill's own specifications and guarantee.

The tendency of some rails to flow over and form a "lip" has been referred to and this frequently is attributed to mere softness of the steel. Our experience has been that a rail with carbon as low as even 0.33 per cent. will not flow over under exceedingly heavy traffic, provided sound steel is present, with granular form fine enough to render the metal tough and strong; and in every instance of flowing over or of breaking down of the side or corner of the head, we have found the presence of blowholes or other unsoundness near the surface or corners of the head of the rail, generally within one-eighth or one-quarter inch of the surface, whereas in the cases in which the rails have sustained long and heavy traffic we have found comparative freedom from such defects. A case of this kind which was investigated a couple of years ago will illustrate the point.

A number of rails from a single rolling had mashed down in track after two months' wear to the general form represented by Fig. 5, the broken line representing the template. These defective rails were upon curves and upon tangent, and were from various heats throughout the rolling, but rails from the same heats and immediately adjoining the defective rails were unaffected by the traffic.

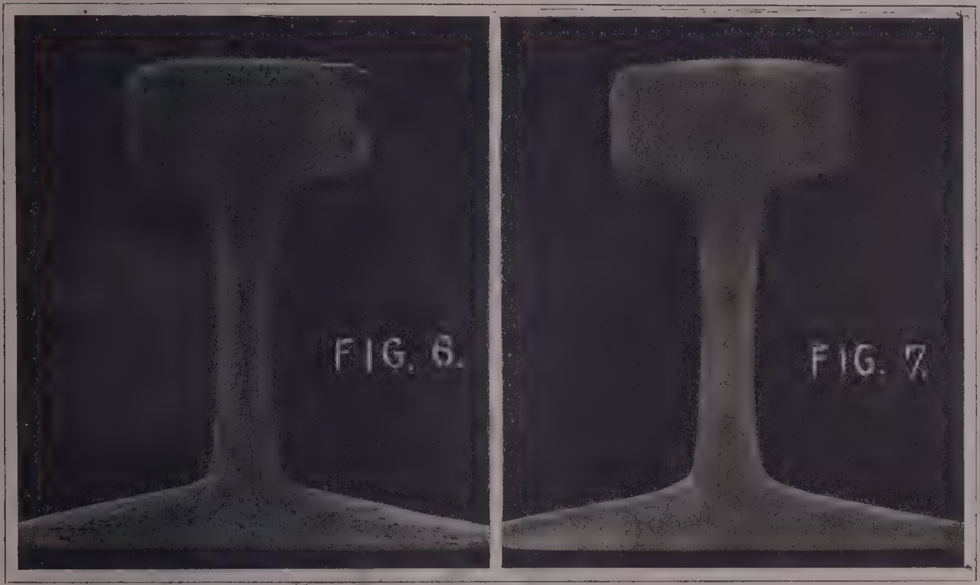


FIG. 6. FIG. 7.

Unsound and Sound Rails Adjoining in Track, 2 Months Service.

It was found that composition had nothing to do with the failures, but upon polishing and etching the sections we found in the cases in which flowing and splitting occurred, that the steel was unsound, as indicated in Fig. 6, while the rails adjoining which were in good condition were of sound steel, as indicated in Fig. 7.

We have also investigated a considerable number of rails to determine whether or not the form of section exerted an influence upon the tendency to crush in service, and it has been clearly proved that ability to withstand crushing under heavy service is due not so much to any particular form of section, as to the relative freedom from unsoundness in the metal. In connection with this question an examination was made about a year ago upon a lot of rails which were removed from the main track and relaid on branch lines. The section had a rather deep head with contour approximating that of a wheel flange. Practically no flowing and no crushing was found in these rails after 15 years' service, while a number of rails of the American Society section laid in adjoining parts of the same track had crushed and otherwise failed in a very few years. The composition of the different lots showed comparatively little variation, but in the case of the rails which crushed in service we invariably found unsoundness, of the general type indicated by Fig. 6, whereas in the good rails the steel was practically sound within one-half inch of the surface of the top and sides of the head. In other words, the good service was due mainly to the greater care exercised in the manufacture of the earlier rails and their consequent relative freedom from unsoundness.

Up to this point we have made little mention of granular structure of the metal, and it may be inferred that this has little influence upon the permanency of the rail in track. On the contrary, we have reason to regard a uniform fine granular structure of high importance, both in reducing rate of wear and in cutting down liability of fracture, but it is an unfortunate fact that the very best of steel as regards granular form or composition may be completely and quickly ruined, from the standpoint of efficiency in track, or in other words, as to its value as a rail, by failure in manufacture to ensure reasonable freedom from unsoundness. This, to our mind, is an integral point in the manufacture of rails, for if any material degree of unsoundness exists in the rail within a distance, say, of one-quarter or one-half inch from the head or sides and more particularly near the upper corners, unsatisfactory service under heavy traffic is almost certain to result regardless of the composition or method of rolling. Such at least has been our invariable experience.

As to injurious segregation, we find that relatively few failures in track are due to this condition. If ingots are not properly cropped, or if they are allowed to remain in the furnace with the interior of the ingot in a liquid condition for an excessive time, segregation of course results, and if the test butt from each heat is taken, as should invariably be done, from the top of the ingot, badly segregated rails will fail, and consequently under such conditions careful guarding against segregation is as much for the interest of the manufacturer as for that of the consumer. Fig. 8 represents one such rail which failed under the drop test, and the extent of the segregation is shown by the fact that the proportion of carbon at the outside average 0.49 per cent., while at the center of the head borings taken with a quarter-inch drill average 0.76 per cent. Also it will be noted that blowholes extend all along the top of the head. Such cases as this are, however, rare.

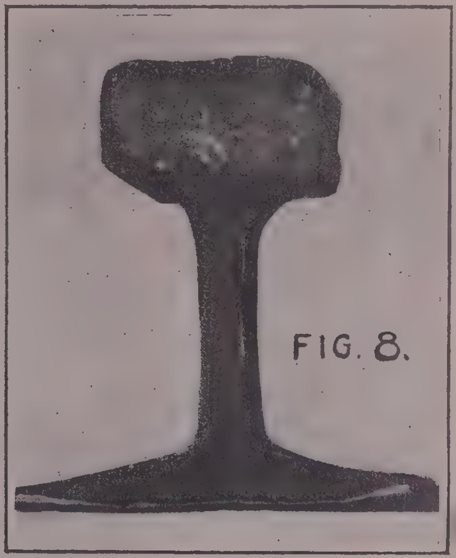


FIG. 8.

Rail of Segregated Steel.

Under "failures due to rough handling" we have found considerable number from time to time. The initial fracture may, of course, occur either at the mill at straightening presses or in loading into high-side cars and letting fall upon other rails 5 ft. or more below, or in letting the rails fall from the loader 6 or 7 ft. upon the ground, and the same thing, of course, may occur after receipt of the rails in unloading unless they are skidded out or otherwise gotten to the ground without any considerable shock. Careful inspection will remedy this condition. A fracture of this type is characteristic. It begins generally across the base of the rail and extends up a short distance into the web, then it works along the web sometimes for a distance of 6 ft. or more, with the face of the fracture in a plane at right angles to a vertical line down through the rail, and the steel finally snaps off up through the head.

A fracture due to this cause can generally be identified at a glance and can be distinguished from a fracture caused by pipes, since the latter extend with the unwelded faces more or less parallel with the contour of the rail.

To sum up, the results of our investigation indicate that the greater part of the difficulty which occurs today with rails under heavy traffic is due to unsound condition of the steel, a condition which existed in comparatively slight degree in the earlier rails.

There has been a marked improvement in practice at some of the mills over that generally prevalent a decade or two ago, and this has resulted at such mills in producing a much finer granular form throughout the section and hence a tougher and better wearing rail, if only the metal were sound, but unfortunately in the essential element of soundness of the steel there has been direct retrogression, making it appear that the main attention in the manufacture has been fixed upon quantity and not quality of the output.

THE SCHOOL OF APPLIED SCIENCE of the State University of Iowa has been reorganized into a college, and the present director of the school, Prof. William G. Raymond, has been made dean. A new fireproof building is being erected, and is expected to be in service before the end of this year. A contract has just been let for the building of a dam across the Iowa River, below the university grounds, which, besides making a sheet of slack water about two miles long on which the university borders, will provide power for the institution and for experimental purposes. Near one end a canal will be constructed across which removable dams of various sections will be placed for the study of the flow over such structures.

Test of a Steam Turbine After Two Years' Service.

There has been quite a discussion of late in the technical papers in regard to the probable deterioration of steam turbines after having been in actual service a number of years, and the effect of service on the steam economy of the machine. On account of the comparatively recent introduction of the steam turbine into this country, the information in this line has been more or less meagre, although this is not the case in Europe, and accordingly the results obtained by Professor Edward F. Miller and R. R. Lawrence, of the Massachusetts Institute of Technology, in tests made recently on a 150-h.p. steam turbine dynamo set, which has been in service at the New England Structural Co. for the past two years, will be of interest.

Shortly before the test was made the turbine was taken apart and thoroughly examined as regards wear, etc., photographs being taken of the turbine wheel, buckets and pinion, which are reproduced herewith, and by examining them it will be noted that the wear on all these parts was practically nil. The owners of the plant have also written as follows on this subject:

"We beg to advise you that the two steam turbine generators purchased of you about two years ago have proved very satisfactory in every way. The wheel and pinion, of which photographs have been taken, have been in constant operation for over a year and a half, and there is no trace of wear appreciable on the pinion or the buckets. In fact, many of the latter still have some part of the original scale made during the process of drop forging."

This machine is one of a pair which were built by the De Laval Steam Turbine Co. at its Trenton, N. J. shops, in the spring of 1903, both machines having been constantly in service at the New England Structural Co., East Everett, Mass., for furnishing power and light for its entire plant. A photograph of the installation is also reproduced herewith.

These machines were ordered under the following steam guarantees: With 150 lb. steam pressure at governor valve and 26-in. vacuum at the turbine; 18.7 lb. of steam per brake-horsepower per hour at full load, and 19.7 lb. at half load. By comparing these figures with those just obtained by Professors Miller and Lawrence, it will be noted that the turbines are still well within their original guarantees, thus proving that the deterioration, if any, has apparently not affected the steam consumption

The test took place June 11, last, starting at 9 a.m. and finishing at 6 p.m., after which the electrical heat losses were obtained in order to determine the absolute brake-horsepower. The steam supplied to the turbine under test came from one boiler. Steam for the auxiliaries and for the feed pump supplying this boiler came from a second boiler. All condensation in the steam main leading to the turbine was returned to the boiler by means of a steam loop.

The steam used was determined by weighing the feed water put into the boiler. The level in the boiler was kept nearly constant during the test, and was made the same at the end as at the beginning.

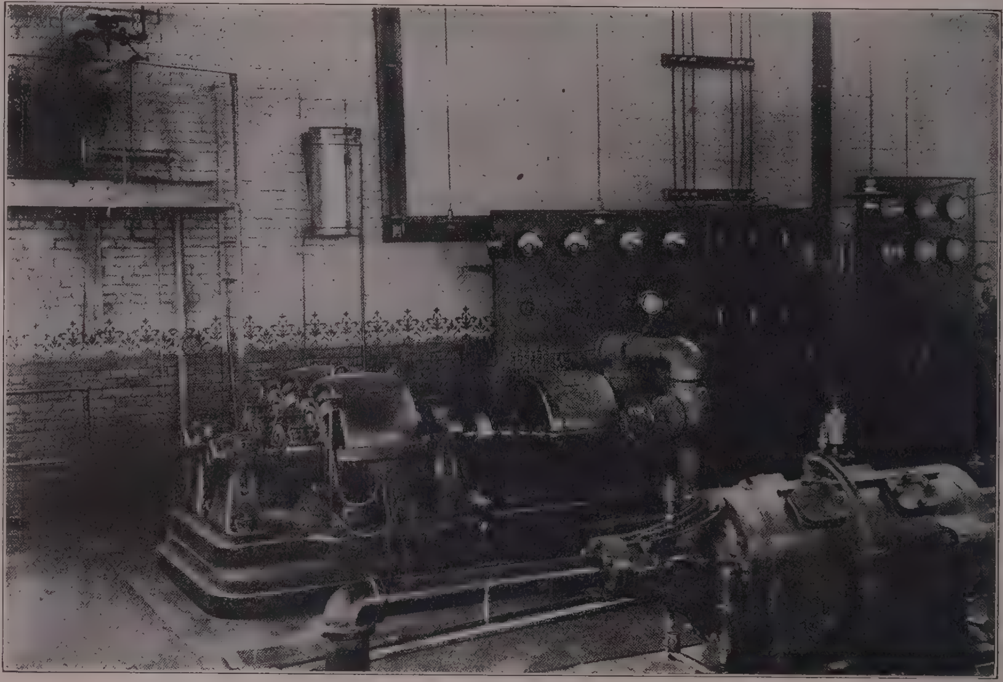
The blowoff pipe and the auxiliary feed pipe were disconnected and banked. All the piping, both steam and feed, was kept tight, and there were no leakages to make allowance for, all the water put into the boiler being used in the turbine and in the calorimeter.

The feed water was weighed in a barrel on a pair of scales sensitive to less than one-quarter of a pound under maximum load. The water weighed was run into a small barrel beneath the scales. The feed pump pumped from this barrel to the boiler. It is probable that the water weight is correct to less than 25 lb. in the total.

The quality of the steam was figured from readings taken on a throttling calorimeter placed near the throttle of the turbine. The time the calorimeter was in use was noted and the amount of steam used by it was calculated by Napier's formula. The orifice used to do the throttling was ¼-in. in diameter.

Pressures were taken at the throttle and in the case supplying the nozzles. This latter pressure is beyond the governor, and fluctuates with any change of load. Temperatures of the steam at these two places were taken also. It was thought that the throttling by the governor might dry out any slight amount of moisture in the steam, and that the steam entering the nozzles might be slightly superheated. During this test the throttling was slight; and there was but little change in the quality of the steam in passing through the governor valve.

The vacuum was measured by a U-tube filled with mercury. The poorer vacuum obtained near the middle of the test was due to low water in the river.



Turbine Plant of New England Structural Company.

The electrical output was taken up in a water cooled resistance. The necessary electrical instruments were inserted for the measurement of the power. The load was very steady throughout the test.

Previous to starting on the test, the turbine had been running 45 minutes. Turbine ran with but little noise.

Test of De Laval Turbine.

Duration of test, hours	9
Boiler pressure gauge, lb.	152.9
Boiler pressure below governor valve, lb.	145.9
Number of nozzles in use	6
Quality of steam, priming, per cent.	1.05
Barometer, in.	29.90
Vacuum, in.	25.47
Average volts, dynamo No. 1	262.7
Average volts, dynamo No. 2	262.1
Total amperes	202.0
Average total kw. output	106.1
Average total e.h.p. output	142.2
Average total b.h.p. input	160.4
Average number of revolutions per minute	1,200.0
Total steam used for nine hours, lb.	25,661
Average steam per hour, lb.	2,851.0
Aver. steam per hour, corrected for moisture, lb.	2,826.0
Steam per kw.-hour, lb.	26.49
Steam per e.h.p.-hour, lb.	20.05
Steam per b.h.p.-hour, lb.	17.77
Steam per b.h.p. hour, corrected for moisture, lb.	17.62

The electrical instruments were all calibrated before and after the test, by Prof. F. A. Laws, also of the Massachusetts Institute of Technology.

Sanitation in Manila.

The sanitary problem in Manila is one of unusual interest, and its solution will call for such varied works, considerably different from those used in temperate climates, that their design will prove novel to engineers accustomed only to the methods followed in the United States. A good description of the conditions that exist in the Philippine capital has been contributed by Mr. O. L. Ingalls, engineer in charge of the sewerage system, to the "Transactions" of the Association of Civil Engineers of Cornell University, from which the following account has been taken:

A very large part of the water closet and other domestic drainage is at present discharged into vaults, cess pools, or old storm water drains, from which it eventually finds its way into the esteros, the moat, the river, or becomes absorbed by the porous, sandy sail. Another method of waste disposal quite common in the Orient, and introduced to a limited extent in certain parts of Manila since the beginning of the American occupation, consists in the nightly collection of about 3,000 pails, the contents of which are emptied into a barge which is daily hauled out to sea and discharged several miles from shore. The pails in question are provided with tight-fitting covers and during the day act as a receiver in the closet for all solid and liquid wastes. These pails are in most common use in certain densely populated districts occupied almost exclusively by the native element, who reside in diminutive nipa and bamboo houses, situated very close together and built with little or no provision for toilet accommodations. In these localities the city has amply provided public toilets with the pail installation, which arrangement has greatly improved the former sanitary conditions. Although the pails are exchanged and cleaned every twenty-four hours, and the most hygienic methods used in their care, yet in this tropical climate they are very undesirable and should be dispensed with as soon as a more suitable substitute can be provided. In some of the older parts of the city human wastes are collected in masonry vaults, frequently two stories in height. During the Spanish régime the custom appears to have consisted in the removal of the accumulations from these after long intervals, this being accomplished by breaking a hole near the bottom of the masonry, and conveying the contents, not infrequently through a shop or dwelling, in order to reach the nearest public passageway or street.

While the conditions already described have been improved as far as possible since the American occupation, yet at best they are still in far from satisfactory condition and will continue to be a menace to the public health until such time as it is possible to provide a more comprehensive system of waste disposal for the entire city. Manila is unfavorably situated, especially from a sanitary point of view. It has been constructed upon a rather unstable foundation, consisting of an alluvial deposit of fine sand and clay, and its topography is such that at high tide many unimproved parts of the city are totally submerged, while the improved sections are situated at an elevation but slightly above high tide in the bay, rendering large sections of the city subject to serious inundations during the wet monsoons, when downpours of great intensity are of frequent occurrence.

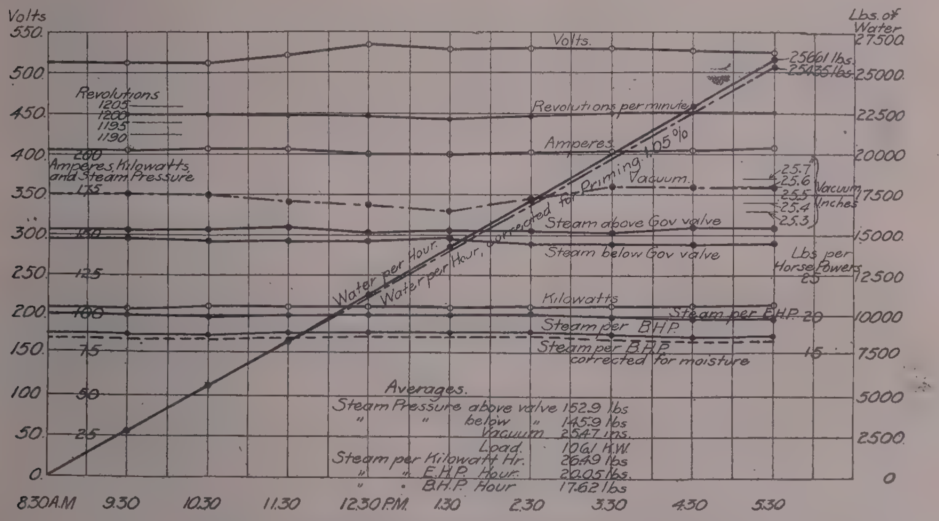
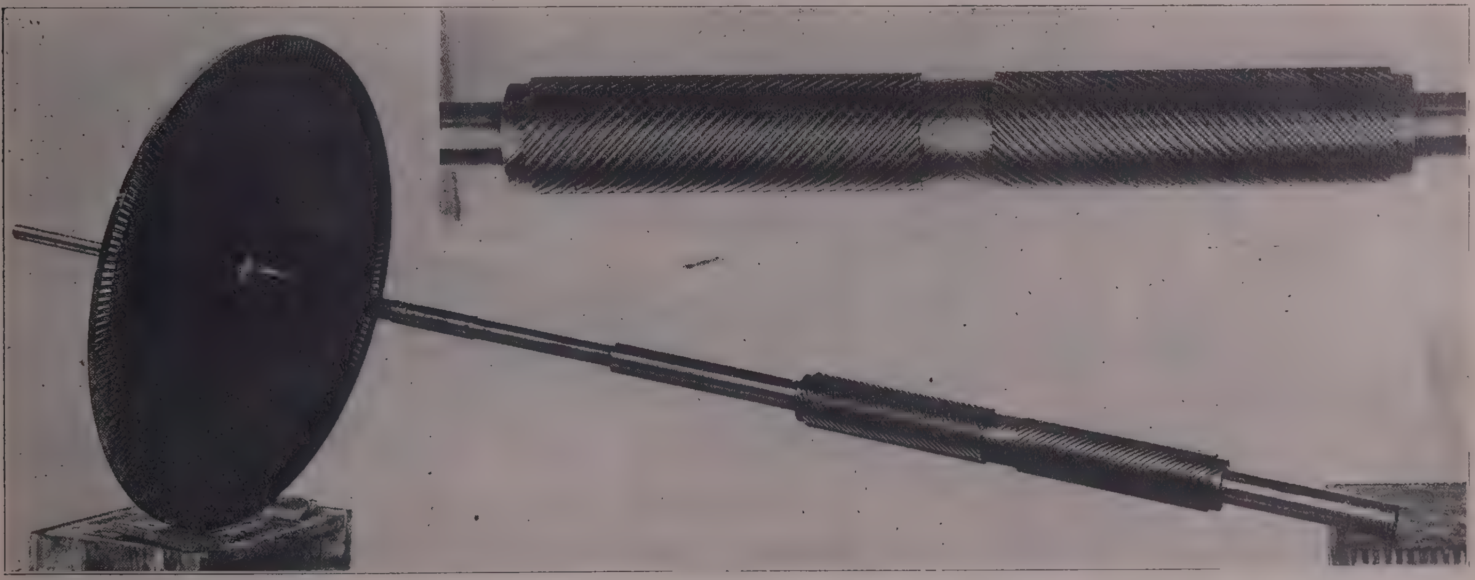


Diagram of Results of Tests of Turbine after 2 Yeara' Service



Bucket Wheel and Pinion of DeLaval Turbine after 2 Years' Service.

The population of the city at the last census amounted to about 225,000 inhabitants, of which number over 16,000 had no abode except upon the water, living in boats of various kinds, for which the locality is famous. In many parts the population is extremely dense at the present time, especially along the bay in the Districts of San Nicolas and Tondo, where in certain places it reaches nearly six hundred persons per acre, and that, too, in spite of the fact that almost no houses are more than one story in height. These localities of dense population are a source of great anxiety and annoyance during epidemic periods on account of the intense ignorance of the native population, rendering the observance of proper sanitary measures almost hopeless. The tendency at the present time is to discourage these dense assemblages of population, which can largely be brought about by limiting the distance between individual houses, which up to this time have been constructed largely of nipa and bamboo, thereby rendering it no longer possible to almost completely cover every inch of available space inside the building lines, as was the custom prior to the American occupation.

A system of storm water drains located mostly within the walled city and in certain other improved sections nears the banks of the river has been in existence for many years. These drains were designed and built under the direction of Spanish engineers, of rectangular blocks of volcanic rock, laid on stone foundations, with brick or stone coverings, without manholes and with little or no mortar. Owing to topographical conditions, many of these drains, in order to be below the street surface, have been laid with almost no grades, and so deep that even at low tide they are partially filled with water. This condition of affairs renders it nearly impossible to remove the large collections of sediment which are constantly accumulating, until the drains become so completely filled that they cease to be of use for the purpose for which they were intended. Pipes for drainage purposes were never introduced prior to the time of the American occupation, and the most diminutive drains were constructed of the material and in the manner already described.

These storm water drains discharge generally into the moat surrounding the walled city, or into the numerous esteros for which the city is famous, and as these drains during late years have been used for disposal of much sewage and other wastes, the tendency has been to convert the moat and the numerous esteros into open sewers, in which the velocity of the currents is so slight that nearly all solid matter from the sewage is deposited, and during the long, dry, hot season these deposits become an intolerable nuisance and a menace to the public health on account of the offensive odors given off, especially at the time of low tide.

The storm water drains now so extensively used for sewage purposes are very uneven, and as they are not water-tight, the soakage of foul liquids into the soil must be very great, especially during the dry season, when a large amount of filthy matter necessarily accumulates and gives off offensive odors through the entrapped storm water inlets, which are the only means of ventilating the present so-called public sewers.

Manila has been provided with a water supply of about 8,000,000 gal. per day since the year 1882. This supply is taken from the Maraquina River at a point about 8 miles distant from the city, and is pumped through a short section of double 24-in. cast-iron pipe to an aqueduct which terminates at a "Deposito," or distributing reservoir. This "Deposito," which has a capacity of approximately 16,000,000 gal., is located about one mile from the city limits and has a flow line about 80 ft. above mean high tide in the bay. This reservoir is a fine type of Spanish architecture and is well adapted to a tropical climate, although inadequate in capacity for a city the size of Manila. It has been built with parallel arched chambers tunneled out of volcanic rock and these chambers have been intersected with cross tunnels, thereby forming a series of groined arches, leaving a roof of the natural rock about 8 ft. in thickness. From the "Deposito" the water reaches the distribution system of the city by means of a 26-in. cast iron pipe laid along the surface of the ground.

A little more than one year ago, Mr. Ingalls, then city engineer of Manila, was directed by the Municipal Board to design an adequate system of sewers which should be best suited for this locality, and at the same time submit a report with drawings and estimate of cost for the same. A careful topographical study of the entire city disclosed the fact that the highest parts were situated at elevations but about 7 ft. above mean high tide, and that the lowest parts were those unimproved sections which were covered with water to a greater or less extent at all times except at the lower stages of the tide. The average mean variation of the tide in this locality is about 3 ft., while the maximum range amounts to about 5 ft. Generally, the larger part of the improved sections of the city have an elevation of about 4 ft. above mean high tide. Under these unfavorable conditions, there seemed to be but one satisfactory solution of the problem presented, which was to introduce a system of pumping stations in connection with a separate system of sewers, by which method only house sewage, liquid waste from manufactories, etc., are admitted to the sewers, whose dimensions have been proportioned to accommodate only the sewage and ground water passing through them, letting the storm water flow upon the surface of the streets or be cared for by means of a separate system of drains. The quantity of sewage conveyed by a separate system of sewers is very uniform, and when properly constructed and operated will leave no accumulations or deposits to generate noxious gases to be removed only at the time of heavy storms. Sewers constructed upon the separate principle will be daily filled to their greatest carrying capacity at the hours of maximum flow, and will be swept clean of solids, thereby preventing any putrefactive change taking place during the rapid movement of the sewage to the point of discharge.

The question of final disposal of the sewage was given careful consideration, although from the first there appeared to be no choice for Manila, the advantages of its position, situated upon a large body of salt water, pointing decidedly to the opportunity for disposing of the sewage without previous treatment by discharging it directly into the bay. At the present time there are so many large cities making use of this method of sewage disposal that the results are no longer of an experimental nature. All substances found in the sewage that would be likely to float in the bay and cause trouble by stranding along the shore are to be intercepted and removed by suitable screens constructed in the sewers at or near the pumping stations.

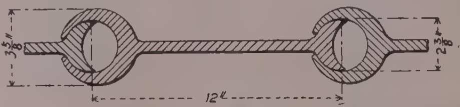
The method proposed for collecting and disposing of the sewage of Manila consists in starting the sewers at their upper ends with a minimum depth below the surface and creating a fall by increasing the depth until they reach a level so far below the surface that it becomes advisable in the interest of economy to raise the sewage by pumping. This operation is repeated as often as found necessary, until finally it is all collected at a main pumping station on the shores of the bay. Here the sewage is raised and discharged through cast-iron pipes laid below the level of the bottom of the bay and extending a mile and one-quarter into the harbor, where the outlet will be placed.

As there are no basements or cellars in the city of Manila, it has been decided that a 5-ft. minimum depth to the bottom of the sewers will be ample for the purpose of affording a proper slope for house connections and furnishing a sufficient depth for the introduction of a suitable flushing system.

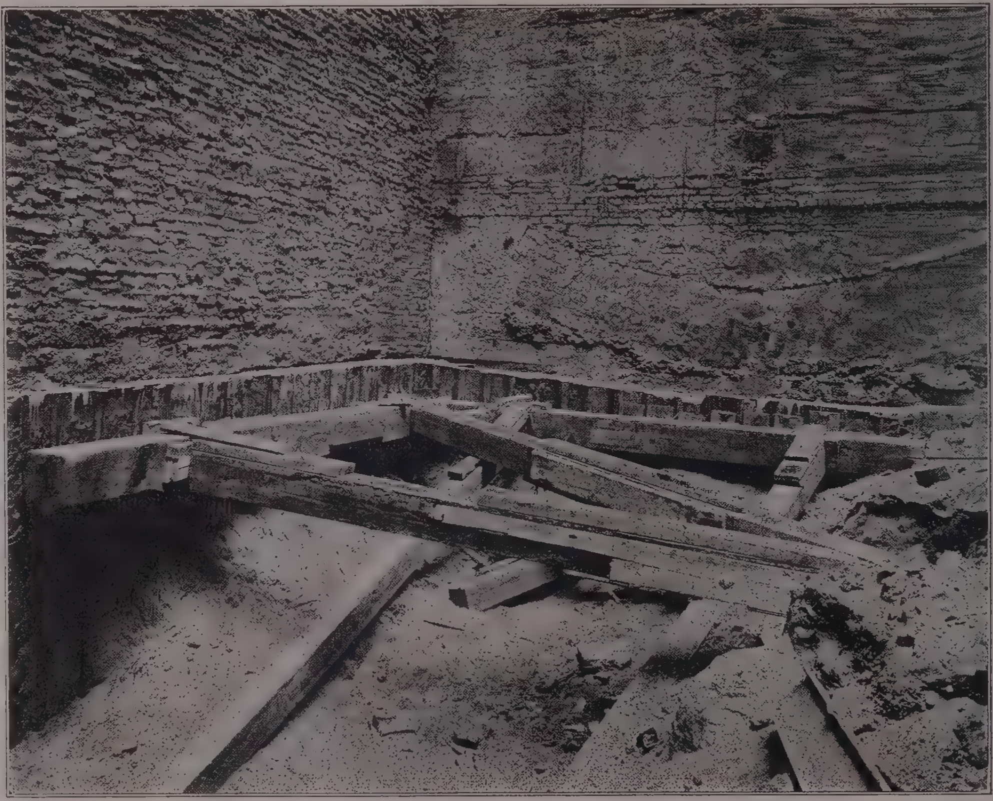
The sewers will begin with a pipe 8 in. in diameter and will be laid at a slope of 1:250, thereby securing a velocity of at least 2 ft. per second when flowing one-half full. The size of the sewers will gradually increase as the flow increases until the largest sewer will attain a diameter of 4.75 ft., with a slope of 1:1000 previous to reaching the main pumping station. Sewers up to and including 24 in. in diameter are to be constructed of American sewer pipe, while those above that size will be of brick and concrete, with bases generally rectangular in form resting upon timber foundations.

All sewers up to and including 18 in. in diameter have been designed to carry a maximum quantity of sewage and ground water when flowing one-half full, leaving one-half the capacity for emergencies. Sewers above that size have been designed to flow 0.7 full, as the larger areas are subject to a more constant and uniform discharge, rendering a larger margin of safety quite unnecessary.

In the design of this sewerage system the estimated amount of flow is to be derived from two sources, namely, domestic sewage and ground water. The amount of domestic sewage reaching the sewers in Manila has been based upon the water consumption, which has been assumed to be at the rate of 80 gal. per capita in each 24 hours, with a maximum flow in the sewers estimated at 50 per cent. greater, or 120 gal. per capita per day. While this per capita estimate of water consumption is considerably greater than has been allowed by English engineers in designing sewerage systems for certain Oriental cities located in the tropics, yet the amount is but little more than one-half what is now generally considered a fair allowance by American engineers for cities in the States where an abundant water supply has been provided.



Flexible Joints of Sheet Steel Piling



Permanent Sheet Piles Retaining Soil Under High Footings.

The ground water infiltration which is likely to reach the sewers has been estimated at 1,250,000 gal. per square mile per day. This estimate of infiltration is much larger than is generally allowed in sewer design, for the reason that in Manila nearly all sewers will be laid at a considerable distance below sea level, in a soil thoroughly saturated with water. This condition of affairs will require extraordinary care in all construction and plumbing work to exclude the seepage water sufficiently to keep even within this limit.

In the system of sewers designed for Manila, provision has been made for the accommodation of 440,000 people, which is practically double the present population. The present requirements will necessitate the erection of six pumping stations, three upon the north and a like number upon the south side of the river, the river dividing the city into two approximately equal parts. Manholes will be constructed at all intersections, at all angles in the line of the sewer, and generally at intervals of from 300 to 400 ft.

Proper ventilation of all sewers is a matter of great importance in this tropical climate, for without it they cannot be maintained in a sanitary condition. It is the intention in Manila to make use of the esteros to a large extent for supplying water for flushing the system, and keeping the sewers clean by removing all putrescible substances as quickly as possible, thereby preventing the formation of noxious gases. It is also the intention to provide numerous and ample openings for the admission of fresh air to aid in promoting circulation. In order to do this, it will be found necessary to dispense with running traps on all house connections and to continue the soil pipe and vent stack full size above each roof, care being taken to secure tight joints and the proper trapping and venting of all plumbing fixtures.

Manholes with perforated covers cannot be used for sewer ventilation in Manila on account of the large number of streets that are sometimes flooded with storm water, due to hard storms, or to floods which sometimes take place during the wet monsoon, caused by the action of the tide, together with extreme high stages of the water in the Pasig River. Perforated covers would admit large quantities of storm water to the sewers on occasions of this kind, and cause the same to become overcharged for quite long periods, to say nothing of the sand and mud which might enter from the unpaved streets at the same time and become a source of great annoyance due to the accumulation of deposits along the interior.

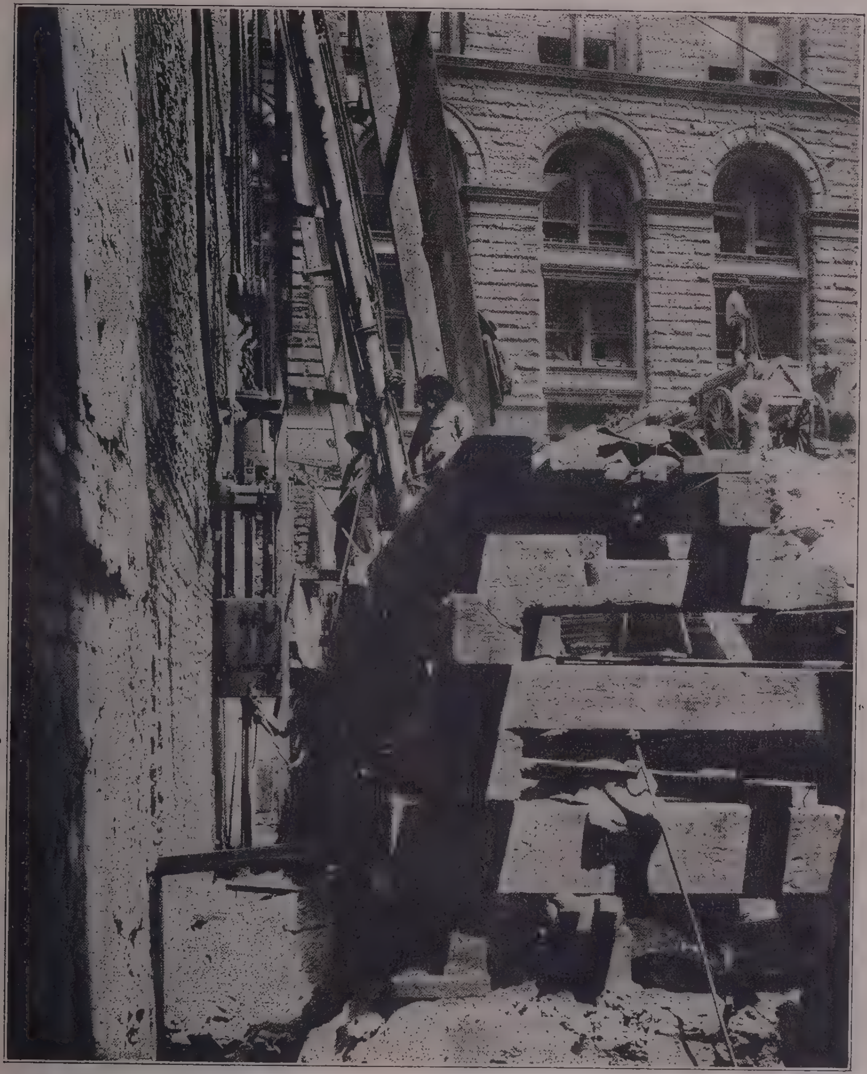
Much consideration has been given to the flushing system upon which the city will depend for keeping the sewers in a sanitary condition. The sewers of Manila have been designed for ideal conditions, namely, that they shall flow at least one-half full at the time of maximum discharge. These conditions, however, will not be realized for many years, and in the primary lateral sewers the amount of flow will generally be found insufficient for moving the heavier particles of solid matter, thereby necessitating the introduction of some artificial method of flushing. The city has decided to construct all terminal manholes of special design, providing them with sewer gates and connections to the public water supply, thereby converting these manholes into flushing basins which are to be operated by hand at stated intervals by responsible parties whose business it will be to fill and discharge the same as often as each particular sewer may require flushing. Additional gates will be introduced along the larger sewers as often as may be found necessary to keep them clean and free from deposits. These gates will be introduced in manholes and wherever possible flushing water will be drawn from the city esteros. The use of estero water for flushing the sewers will serve the double purpose of preventing the unnecessary consumption of the water supply, and also aid in promoting the circulation and purification of the water in the esteros, which otherwise will become very foul and stagnant during the dry season.

The cheap labor of the East has rendered it possible to introduced a system of hand flushing, which for efficiency will far surpass any results attainable by making use of the automatic flush tank that is now so generally used throughout the States for flushing purposes. At this time very little information is available in connection with the proposed pumping arrangement at the respective stations, for the reason that the plans have not been sufficiently perfected to justify a description. All fuels are expensive in the Islands and generally imported from other countries, the exception being wood or charcoal. Bituminous coal of not the best quality, imported from Australia or Japan, is almost universally used for steaming purposes throughout the Islands. Centrifugal pumps will unquestionably be introduced in all pumping stations for the reason of less cost for original installation and the high efficiency of the improved types now being manufactured. Serious consideration has been given to the use of gas engines for power in all smaller pumping stations, operated in connection with suction producer gas plants, using charcoal for fuel, which is plentiful in the Islands and reasonable in cost. Makers of gas engines are willing to guarantee a consumption of not over 1½ pounds of good grade charcoal per brake horse-power per hour. By this arrangement it will be possible to generate power at the rate of about 18 cents per brake horse-power per day of 24 hours, which is unquestionably by far the cheapest power to be had in the Islands.

There is also said to be an abundance of undeveloped water power in the Islands situated about 60 miles from Manila. In case the supply would warrant, this might be devoted to generating electricity which could be conveyed to the city and made use of, not only for operating the sewage pumps, but also for lighting the streets, operating the railways, and furnishing any other power that might be required for public or private purposes. It is believed, however, that under the existing conditions, the demand for power would scarcely warrant the large expenditure that would be necessary to carry out such an undertaking.

Steel Sheet Piling to Secure an Old Foundation.

The 18-story extension of the Tribune Building, Park Row, New York, is a standard steel-cage structure with grillage foundations carried down to a total depth of about 23½ ft. below the curb, or 7½ ft. below the footings of the present 11-story Tribune Building, which has a side wall 105 ft. long, with its face on the lot line. It is proposed to carry up this wall to a height corresponding with that of the 18-story new part, and in order to avoid the delay, expense and possible hazard of underpinning it, a method has been designed of securing the soil underneath by permanent steel sheet piling, so as to prevent its settlement or the escape of the subsoil below it into the new excavation. The lot to be occupied by the new building is 105 ft. deep and has a front of 58 ft. at Nos. 7 and 9 Frankfort St. It was previously occupied by several brick buildings from one to four stories in height, with their cellar excavations and footings carried down about 8 ft. below the curb. The soil here consists chiefly of a mixture of fine sand and gravel, which runs badly when excavated, and there are irregular layers of loam from 1 to 8 ft. thick, which will stand at a slope of about 40 degrees. The groundwater level has not yet been determined, but, judging from conditions in the neighborhood, it is expected to be about 36 ft. below the curb.



Steam Hammer Driving Permanent Steel Sheet Piles 10 in. from Face of Wall.

After razing the old buildings the adjacent wall of the Tribune Building was shored by four inclined timbers 70 ft. long, with their feet set 10 ft. clear of the wall on timber cribbing and a trench a few feet wide was excavated along the face of the old wall and at right angles to it at the rear end. It was carried down to within a foot or two of the bottom of the footing. In this trench, as close as possible to the present wall, there is now being driven a continuous line of interlocking steel sheet piles furnished by the United States Steel Piling Co. The piles are of the standard pattern with webs ⅜ in. thick, weigh 35 lb. per square foot and cover 12 lin. in. each. They are received in lengths of 13 ft. 4 in. and are driven until their tops are 1 ft. above the bottoms of the old footings. This carries the lower ends about 8 ft. below the lowest point of the new excavations and is considered far enough to prevent any danger of lateral movement of the sand beneath them.

Driving was commenced at the rear of the lot, about 20 ft. from the wall of the Tribune Building, in the trench at right angles to it, and a row of piles was driven extending to the building, so as to form a buttress for the row parallel with the wall. The piles are driven with the small flange in advance, as it is found that the large or outside flange drives more easily after the smaller flange and avoids obstruction in the socket. When the line of piles reached the face of the Tribune Building a special pile with bent web was driven to turn the corner, and the driving was continued parallel with the face of the building and as close to it as possible. The web of the pile does not vary more than ¼ in. from a mean of 10 in. from the wall, a distance which is determined by the dimensions of the hammer. Except for the difficulty of driving so close to the wall, there is no trouble in driving the piles, which has been accomplished as quickly as 2½ minutes each, corresponding to 220 blows of a 1,800-lb. hammer with a 30-in. stroke. The piles are driven with good alignment, and the space between their tops and the wall is filled with a thin layer of concrete, protecting the sand and giving a finished appearance to the construction.

A Vulcan steam hammer is used and is suspended by a tackle from an ordinary braced derrick, with its sill resting on cribwork or stringers parallel to the wall and the upper end bearing against the wall. It was at first rigged with a pair of suspended leads, bracing the hammer, with its long axis parallel to the wall. Later on this was changed and the piles are now being driven with a single outside lead, braced to the derrick frame and to the timber, the hammer being now suspended with its long axis perpendicular to the wall. At first the piles were driven with the wooden cushion block, but this was afterward dispensed with. After the piles were driven they were temporarily braced against the transverse pressure like ordinary sheeting as the excavation was completed in front of them. So far no material has escaped through the piles, and there has been no indication of settlement in the wall beyond them.

The foundations are being built by D. C. Weeks & Son, general contractors, and the work above described is being executed by Miller, Daybill & Co., Inc., shorers and contractors, Brooklyn, N. Y., under the supervision of Mr. Charles E. Holme, of that firm, with Mr. H. L. Muchemore in direct charge of the work. The steel piles were furnished by the United States Steel Piling Co., Chicago, Mr. C. B. Friday, New York, eastern agent.

Book Notes.

Not content with seeding the country with libraries, Mr. Carnegie has again turned his hand to writing for them. His latest book, "James Watt," is an appreciative review of the life of a really great man, written in a peculiar style, and containing a number of technical and historical errors. The value of the book lies in the light it throws on the author as well as the subject. Watt was only moderately successful as a business man, and the author's comments on the commercial affairs of early engine building and on the management of important affairs generally are decidedly interesting. (New York, Doubleday, Page & Co.; cloth, 8vo, 241 pp.)

Dr. K. Thumm, of the Royal Water and Sewerage Research and Testing Bureau at Berlin, has published under the title "Augenblicklicher Stand der Abwasserreinigung" an address he delivered in February before the Sewage Section of the German Agricultural Society on biological methods of disposal. He discusses their availability as means for securing complete purification of the sewage of small and large communities, their efficiency, the necessity of preliminary experiments before designing works, the choice of methods and the cost of completed plants. He states that investigations in England indicate that these biological disposal works cost from about $3.75 to $7.50 per capita, averaging about $5, exclusive of the land. His conclusion is that at the present time the new methods of disposal do not offer any advantages over those heretofore employed in Germany. Copies of this pamphlet, valuable as expressing a view of recent developments not often printed, can doubtless be obtained by addressing the author at 73 Kochstrasse, Berlin.

The three imposing volumes containing the "Transactions" of the International Electrical Congress of 1904 form the most important single contribution to electrical literature that has appeared in a long time. Every field of the subject is taken up, and the great advances in the theory and applications of electricity in the last decade are explained by the men to whom is due most of the credit for such progress. In view of the space given to the Congress in these pages last year it is unnecessary to print any extended review now of the 2,844 pages in which its papers and discussions are preserved. Two features of them deserve comment, however. On the fly leaf of each volume is the note, in bold type, "Not Copyrighted, Publicity Invited"; the contrast this affords to the bogus secrecy of the International Railway Congress tells its own story of the value of the two meetings. The second feature deserving comment is the fact that the very onerous work of editing them and supervising their publication was very largely done by Mr. W. D. Weaver, editor of the "Electrical World and Engineer," who gave time and strength to this work at great inconvenience to himself and with full knowledge that he would never even be thanked for the many weeks of hard effort involved.

Letters to the Editor.

The Hauck Building.

Sir: I note in the Record of July 1 you have given me credit for the article on page 17 entitled "Hauck Building of Reinforced Concrete." This article was prepared by Mr. H. W. Vehrenkamp, our chief engineer. The building was designed by Prof. C. A. Marks, of the University of Cincinnati. Will you kindly publish this letter so that these gentlemen may receive the credit they deserve?

Very truly yours, W. P. Anderson.
Cincinnati, July 5.

Rate of Operation of Contact Beds.

Sir:—In the report of the sewage purification plant at Charlotte, N. C., by Cecil C. E. Beddoes, appearing in your issue of June 24th last, it is stated that for several hours at a time tank effluent is treated by the filters (contact beds) at a rate of upwards of 1,600,000 gal. per acre bed per day and that a uniformly non-putrescible filtrate is obtained. In view of your editorial reference to this plant in last week's issue, we think it possible that some of your readers may gather an erroneous impression as to the daily rate at which the Charlotte beds are operated. This figures out at 659,671 gal., khich is much less per acre-foot than is represented by a six-hour cycle at the well-known Manchester, England, sewage works.

Doubtless what the writer of the report intended to emphasize was the remarkable uniformity of the results obtained in the use of contact or outlet-controlled beds with a tank effluent as uniform as that shown by the chlorine chart, irrespective of the rate at which the beds are filled. This, we think, is of special interest in estimating the value of the contact-bed method of treatment. There can be little doubt that percolating filters, now working successfully in Europe at rates which exceed 1,000,000 gal. per acre bed per day, will be largely made use of in those cases where the climate and other local conditions render their adoption feasible. But inasmuch as the line between their success and failure is such an exceedingly narrow one, and the operation of automatic sprinklers cannot be assured without the services of attendants, an added interest is given to such cases as the one at Charlotte, where a satisfactory filtrate is obtained in a shallow contact bed, fed by gravity flow at widely varying rates during the 24 hours.

By the use of outlet-controlled beds equal distribution of tank effluent is assured. Therefore the results above referred to seem to confirm the opinion held by many, that the feeding of filters with the same quantity of sewage each time is a matter of particular importance, but it is not as essential to have fixed periods during which the beds rest full and rest empty.

Yours very truly, Merritt & Co.
Philadelphia, July 3.

Failure of Small Dams in Colorado.

Sir:—Two small irrigation reservoirs burst during the high water of the past spring on the headwaters of Leroux Creek, under conditions which present some unusual features. The larger reservoir covered about 25 acres, having a dam of about 25 to 30 ft. high, and a capacity of perhaps 250-300 acre-feet. The smaller one covered about half this area. The dams were both earthen, and, so far as I can learn, well built. They were both on small creeks, and the runoff from the watersheds of these small streams had to pass through these reservoirs. The circumstances of the break were peculiar. The larger reservoir had a wasteway of 10 ft. width, amply large; ordinarily, to carry off the surplus water. But this year there was a fall of 6 to 10 ft. of snow on the watershed, and it did not begin to move until late. The elevation of the reservoirs is about 9,000 to 10,000 ft. Snow melted only on the south slopes, and there for only a short time each day. The water filled the reservoir and then ran into the wasteway, which being filled with snow, clogged and froze into ice each night. The result was that the water could not get out of the wasteway, and I am told that it rose several feet above the top of the dam before bursting it, practically freezing a new ice dam of its own. The only remedy seems to be to cover the wasteway or make the outlet large enough to serve as both outlet for flood and irrigation waters. There is no way of obtaining an estimate of the damage to the reservoirs now. It must be considerable, and as the earth lies in a thin layer on the gravel at both sites, it will be expensive to repair them. Numerous ditches were damaged by the rise occasioned by the bursting, and some small farms along the creek were overflowed. At this point, 20 miles below the reservoirs, the water rose 3 or 4 feet above the high water level of the creek.

Yours truly, Fred S. Hotchkiss.
Hotchkiss, Colo., June 23.

A Reinforced Concrete Dome, 130 ft. high above the springing lines, has been erected on the new central railway station at Antwerp. It consists of four large vertical side lights placed around the sides of a square, with the dome proper resting on them and a campanile above the dome. Each side light is in the form of a gallery with seven arcades surmounted by a semi-circular arch with a 32.8 ft. radius. Each arch is framed in an archivault, 11.5 ft. high, on the extradoses of which rest the haunches of the dome. The dome proper consists of two superimposed shells at a distance apart varying from 3.28 to 6.56 ft. The internal shell forms the ceiling of a hall below and is decorated with sunken panels which have only flat ribs along meridian and parallel lines on the inside of the shell. A part of these ribs is formed by a skeleton of joists and stringers supported on a horizontal annular beam, 4.92 ft. wide, which passes through and rests on the tops of the archivaults and on four Y-shaped columns formed at the corners of the square in which the side-lights are placed. The exterior shell has a uniform thickness of 3.15 in., with its weight distributed on 6 moulded ribs following meridian lines. It is supported on the internal shell by braces normal to both surfaces in order to permit unequal expansion due to the sun striking it obliquely. The entire structure weighs 1,800 tons, and is said in "Engineering" to rest on the columns at the angles of the side-light square.

CURRENT NEWS SUPPLEMENT

JULY 15, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers, Secretary, Chas. Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary; Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga. Annual meeting, Chattanooga, Aug. 30-31.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

WESTINGHOUSE DIRECT-CURRENT ENGINE-TYPE GENERATORS.

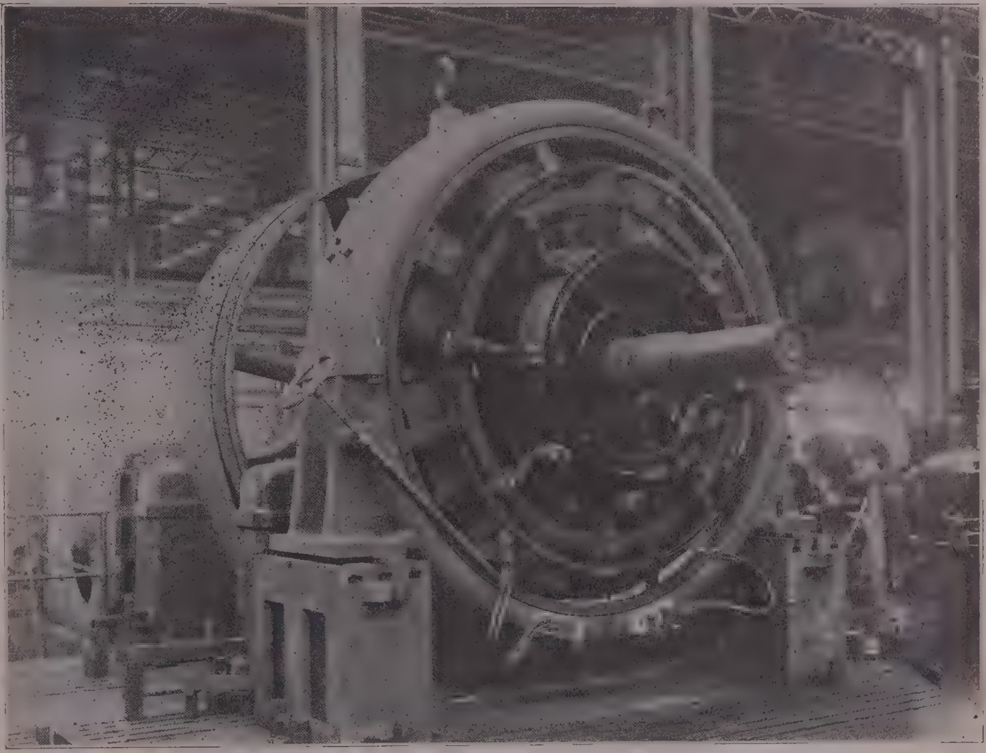
Although most of the innovations in electrical power plant work are taking place in alternating-current apparatus, manufacturers are in no way neglecting their direct-current machines, and as an indication of this attention may be called to the revision of designs that has been taking place in the direct-current, engine-type generators made by the Westinghouse Electric & Mfg. Co. In this revision particularly attention has been paid to securing accessibility of the parts, good performance and low running temperature. Special attention is called by the makers to the arrangement of brush holder rings and commutator, the position of equalizer rings, the use of retaining wedges in the armature slots, the arrangement of series field coil connections, removable pole pieces and brush holder shifting device contribute to the best performance and the utmost simplicity in operation.

The stationary part of these generators is a circular yoke of cast iron carrying inwardly projecting poles on which are placed the field windings. For capacities from 25 kw. up to and including 125 kw. the standard construction is a vertically split frame, while for larger sizes the horizontal division is regularly built. Machines below 25 kw. have solid frames. Generators of any size can be built with either the vertical or horizontal division if circumstances require it. The pole pieces are built up of laminations of soft steel, carefully annealed by a special process and riveted together under pressure, and held in place by bolts which pass through the yoke and are fastened by lock washers on the outside. The bolted-in construction allows the removal of any one of the field coils with its pole without disturbing any other part of the machine. Spreading pole tips serve the double purpose of giving an excellent commutating field under the pole tips and of furnishing a support for the field coils.

The shunt and series coils are separately wound, with an air space provided between them. The series coils are made of forged copper conductors of rectangular section and the shunt coils are machine wound. These generators are usually over-compounded for an increase in potential of about 10 per cent. at the terminals from no load to full load, but may be adjusted for lower percentage of compounding by means of a shunt to the series coils, or they may be designed for a higher percentage as may be required for special cases.

The armature core consists of sheet steel stampings, built up on a spider which also carries the commutator. The armature may be drawn from the shaft if necessary without disturbing the commutator or windings. Air spaces are placed at short intervals, and extra spaces are provided between the outer laminations and the end plates. The coils are machine formed and interchangeable. By placing fibre wedges in V-shaped grooves near the top of the slots, the coils are held in place without the use of band wires.

The brush-holder mechanism is carried by brackets mounted on a rocker ring concentric with and carried on a machined seat on the front end of the field frame. No part of the supporting ring projects over the commutator face, thus leaving the brush holders and commutator clear of obstructions and readily accessible at any point. Every machine is so arranged that the rocker ring shifting device may be placed on either side. The transmission of current through the springs, and the consequent heating and variation in pressure are eliminated by copper shunts connected directly from a clamp on each brush to the solid part of the holder. Ample means are provided for adjustment as the commutator wears, and for changing the spring tension on the brushes.



350-KW. WESTINGHOUSE DIRECT-CURRENT ENGINE-TYPE GENERATOR.

An important feature in connection with these generators is that all brushes of the same polarity are maintained at the same potential. Much trouble has frequently been experienced in the operation of large multipolar direct-current machines with parallel wound armatures, owing to the difficulty of securing the same magnetic strength in all the poles. Sometimes the potential generated in the conductors under one pole exceeds or is less than that generated in conductors similarly situated under another pole of the same polarity, the result being a difference of potential between brushes of similar polarity. Troubles caused by currents flowing from one brush to another or from one section of the armature winding to another, attended by annoying and wasteful heating of the conductors and sparking at the brushes are eliminated by the following method of balancing:

In the larger machines with parallel armature windings the points in the armature winding which are normally of equal potential are connected by leads through which currents may pass from one section to others with which it is connected in parallel. These currents are alternating in character and lead or lag with reference to their respective e.m.f.'s, and thus magnetize or demagnetize the field magnets so as to produce automatically the necessary balance between them. The same troubles would result from the decentralization of the armature in a multiple winding, but are avoided by the system of balancing.

With the balanced magnetic circuits any heavy magnetic pull on one side of the armature due to wear of the bearings is prevented. The pull which may be exerted by one side of the field on a large armature, even if out of center by a small fraction of an inch, may become as high as several tons if this method of balancing is not used. Such an increased pull on the armature would result in the heating and rapid wearing of the bearings. By the above method of balancing the induction under all poles is maintained practically the same, causing the magnetic pull to be equal at all poles and preventing an unbalanced pull.

TRANSITE ASBESTOS LUMBER.

The advent of modern fire-proofing precautions has led the H. W. Johns-Manville Co., New York, to produce a material which can be adopted by the architect and engineer in place of wood and other inflammable materials. This company is now able to put upon the market an asbestos fire-proof lumber, the possibilities of which are almost beyond calculation. This lumber is made of asbestos and is called Transite or Transite asbestos fire-proof lumber. It is made in varying thicknesses from ⅛ to ½-in., and in standard sheets 40x40 or 42x44-in. It can be built up in larger sheets or curved as desired to meet the required conditions. In its simplest form, Transite is a firm, fire-resisting board. Its main claim is its adaptability to an almost unlimited variety of requirements. It has been adopted by the Interborough Rapid Transit Co., of New York City, both in the elevated and in the subway cars, for lining switch panel boxes, for the complete floor covering for the underbody of the wooden car, motor car, and on their sheathed and steel cars it is used in the deflector boxes and ducts for the motor leads, for all car wiring. Also as a lining for the walls of panel boxes and cut-out boxes. In fact, wherever its fire-resisting, heat-insulating and arc-deflecting qualities are desired. Transite is also being used as a flashboard behind the fuse box on the third-rail contactor. The Montreal St. Ry. Co. has just placed an order for 150 linings for type K-10 railway controllers, together with equipments as above named. The manufacturers also state that they have just completed a roof made of Transite, consisting of 900 squares, sheets, 42x44-in. each, put on like shingles, overlapped with Transite strip molding for the up and down joints. This, in factory construction, directly overcomes a defect, hitherto unconquerable, where there is danger from corrosion on account of fumes, such as sulphuric acid fumes, etc., iron rust, to which Transite presents a barrier. A smoke-jacket made of this material is now available for the purpose of carrying off the acid fumes engendered in the numerous furnaces, and where the use of soft coal is prevalent, which attacks the iron, tin, or other metallic material, corroding and eating its way to the inevitable destruction of the ordinary jacket, as well as the iron, tin or other metallic roofing.

It may be interesting to state the results of the tests given to this material by the Shawinigan Water & Power Co., Shawinigan, Quebec. A piece of Transite was boiled in water for 15 minutes; then taken out and again boiled for 10 minutes. The edges turned up or warped very slightly, indicating a minute degree of absorption. It was then subjected, in its wet condition, to a heat test for 15 minutes over a white-hot blast. The material came out whole, except for a slight hardening and brittleness, but retaining all its fire-proofing qualities. It was then tested as an arc-deflector on a circuit of 500 volts at 150 amperes. It took 11 minutes of constant arcing to burn a hole through it. This piece was only ¼-in. thick. Transite was tested in conjunction with other boards of a similar character, and was the only one which stood the test, the other, after the boiling test, in the heat test blew up, indicating the presence of much moisture which was absorbed during the boiling process.

Besides possessing the acid-proof, steam and moisture-proof, fire-resisting, heat-insulating and other properties, this board is vermin-proof and in this regard its possibilities are large for use in hospitals as a flooring, ceilings, walls, etc. Its non-absorbing qualities will practically eliminate the transfer of disease germs after thorough fumigation. Transite will take a screw or nail the same as wood, and can be sawed, cut, planed or otherwise manipulated to meet the requirements.

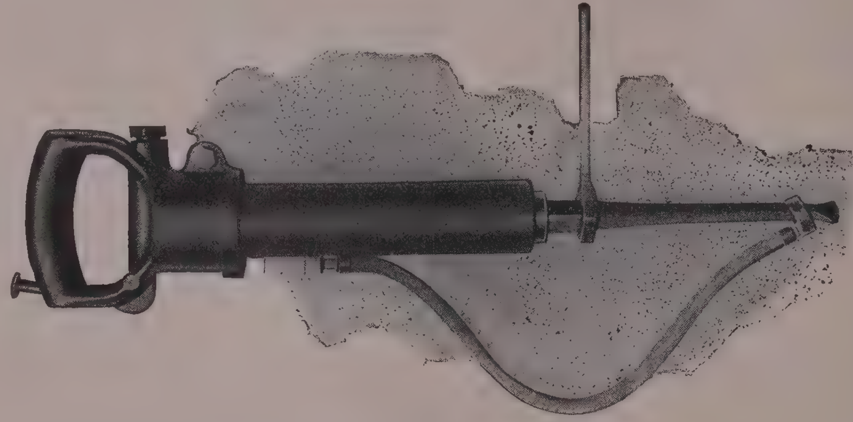
A PNEUMATIC PLUG DRILL.

Contractors who had an opportunity of visiting the granite quarry at Clinton, Mass., from which stone for the Wachusett dam was taken, frequently spent considerable time in watching the operation of a pneumatic plug drill. With this appliance it was practicable to drill a ⅝ x 3-in. hole and shift to the next place for a hole in considerably less than two minutes. The work was much easier than hand drilling and the rate at which it was performed was maintained uniform instead of falling off toward the end of the day, when a hand driller is so tired that he generally fails to keep up with the morning average.

The tool is the result of long experience in making pneumatic appliances for stone-working purposes, and is very simple. It has a push handle throttle valve, which is convenient for this class of tools, and is held in one hand. This leaves the other hand free to rotate the bit by means of a wrench. The makers carried on numerous experiments while perfecting the design of the apparatus and are convinced that a self-rotating drill is not a satisfactory tool under the hard usage of a quarry. As the workman has one hand free, it is no trouble for him to use the wrench. The experiments also enabled the makers to design the tool so that, without reducing its high speed, the air consumption was cut down to a small amount; at the Wachusett dam, it was estimated that about 15 cu. ft. per minute at about 70 lb. pressure were required. The barrel, where the hardest wear comes, is case-hardened and ground very carefully. It is locked in the sleeve by the use of a positive-action tangent ratchet, which keeps the barrel from unscrewing and allowing the valve box to hammer.

In regular commercial quarries where compressed air is usually available, the tool ought to pay for itself in a short time, for a man can accomplish a great deal more work with it than by hand drilling. Even where a large air compressing plant has not been provided, a small compressor driven by a gasoline engine or electric motor can be obtain for a comparatively small sum and will furnish air for several drills; such plants require practically no attendance. The drill is made by the Thos. H. Dallett Co., Philadelphia.

The Davenport Locomotive Works, Davenport, Ia., has begun the publication of a series of pamphlets describing industrial locomotives, which will be sent to all users of such equipment who will ask to have their names put on the mailing list for them. The first describes the Forney type of rear-tank, four-wheel, connected locomotive with a four-wheel trailing truck, familiar through its long and excellent service on elevated railways. The second describes the saddle-tank, four wheel, connected type for coal or wood fuel, which is a favorite with many contractors for earthwork. Each pamphlet gives complete data concerning the sizes in which the style described is manufactured.


THE DALLETT PNEUMATIC PLUG DRILL.

TRADE PUBLICATIONS.

The No. 3 Overstrom concentrator has recently been redesigned and improved by the Allis-Chalmers Co., Milwaukee, and its new form is thoroughly described in a special catalogue. It is made of steel and iron throughout, with the exception of the table top, and has been given a new head motion which increases the operating rate of the apparatus materially. The method of imparting reciprocating motion to the table and the mechanism for carrying the table are new. The operation of the table is explained by means of a number of colored diagrams.

Henry A. Hitner's Sons, Huntington St. and Aramingo Ave., Philadelphia, have issued a catalogue of steel girders, shapes, engines, boilers, tanks, pipe, rail and other new and second-hand building material and contractors' plant which they are prepared to ship immediately. The company makes a specialty in handling such supplies, and among its present offerings is a complete steel building 200 ft. long, 60 ft. high and 37 ft. wide, and a 50-ft. double-track bridge of 32 tons.

A little manual on the preparation and uses of concrete has been prepared by the Municipal Engineering & Contracting Co., Railway Exchange, Chicago, for the use of its agents. It brings together in compact shape more useful information on the subject than it would seem possible at first thought to condense in the space, and will be a decidedly useful book for any foreman on concrete work, as well as a good addition to the working library of the engineer. Naturally, a few pages are devoted to the numerous styles of mixers and other apparatus made by the company, but this is done as a part of the discussion of the general subject of making good concrete for different purposes.

The Otto Gas Engine Works, Philadelphia, Pa., has prepared a pamphlet entitled "Some Reasons Why," which explains at length the important details of the Otto gas and gasoline engine. It is not a trade catalogue in the ordinary sense, but rather an explanation of the field of usefulness of such engines and the advantages claimed for this pioneer type. No company is better equipped by experience to tell this story, for in the last thirty years it has developed from a little shop with a capacity of fifty engines per year to a plant covering a city block and capable of building two thousand engines annually.

The Hydrex Felt & Engineering Co., 120 Liberty St., New York, which has furnished waterproofing materials for a large number of important buildings and bridges and has lately been making something of a revolution in tunnel work from a waterproofing point of view, is sending to those interested a folder discussing the important points in waterproofing and a sample of Hydrex felt, the material which has lately been specified on a number of important works.

The Cummings Structural Concrete Co., 4 Smithfield St., Pittsburg, Pa., has prepared a folder describing some of the leading features of its system of reinforced concrete construction for buildings, piles, bridges, etc., and explaininig briefly the advantages of reinforced concrete for various purposes. It might be added that Mr. Cummings has developed his system not only theoretically but also by means of extensive tests on large beams in an apparatus built for the special purposes.

The Koerting gas engine is one of the best known of the two-cycle type, and while it has been introduced in the United States but a few years it has had a long use in Europe, particularly in large sizes driven by blast furnace gas. The most noted installation in this country is the famous equipment at the Buffalo works of the Lackawanna Steel Co. It is made in this country by the De La Vergne Machine Works, foot of East 138th St., New York, which has published an elaborate description of it in a book containing numerous illustrations of installations and many valuable data to those investigating gas engine possibilities.

BUSINESS NOTES.

The Water-Works Equipment Co., 180 Broad, New York, is having constructed a tapping machine to be operated by a 6½-h.-p. gasoline engine, which sets on frame of the machine, the same being geared direct to the shaft. This machine will be able to make a 30-in., 36-in. and 48-in. connection on any size of main from 30 in. to 48 in., inclusive.

Among the contracts recently secured by the Robins Conveying Belt Co., of New York, were those given out by the Semet Solvay Co., Syracuse, N. Y., for the entire coal-handling machinery for the plants at Milwaukee, Chicago and Delray, Mich., consisting of belt conveyors and storing and reclaiming traveling bridges of great capacity and long span. Other work in hand includes ore-handling machinery for the Depue (Ill.) works of the Mineral Point Zinc Co.; belt conveyors and bucket elevators for the power house at the West Point Military Academy, and additional belt conveyors for handling coal at the subway power house of the Interborough Rapid Transit Co.

Ernst Wiener has severed his connection with the house of Arthur Koppel, with whom he had been connected for 18 years, eight of which as manager of the New York office, and has opened offices at 68 Broad St., New York City, under the firm name of Ernst Wiener Co. The new company will make a specialty of railroads and railroad materials for all industries of both narrow and standard gauge. A special factory equipped with all modern machinery has been built in Youngstown, O., for the purpose of exclusively building the specialties of the new firm, so that it is in excellent condition to take care of all business. A large stock of rails, industrial track, switches, cars, etc., will always be kept. Associated with Mr. Wiener in his new enterprise is Carl Koch, for many years chief engineer of Arthur Koppel.

During the six months ended June 30 the Westinghouse Machine Co., builder of the Westinghouse-Parsons type, has contracted for no less than 82,000 kw. in turbo-generating machinery, averaging nearly 1,175 kw. capacity per turbine unit. These machines range in size from 200 to 7,500 kw. The latter will be the largest turbines in the world, and three units of this size are under contract for Greater New York railway and lighting power stations. In the distribution of these machines among the various industries the electric railway has claimed the largest number of machines, averaging 1,496 kw. in capacity; next in order, industrial plants, averaging 571 kw. capacity, and light and power plants, averaging 1,529 kw. capacity. In the order of total capacity, railway plants have required 38,900 kw., lighting plants 26,300, industrial 12,000, miscellaneous 4,800.

The officers of the Crocker-Wheeler Co., Ampere, N. J., manufacturer of electric motors and generators, have been re-elected for the ensuing year. The officers are: Schuyler Skaats Wheeler, pres.; Gano S. Dunn, vice-pres. and chief eng.; W. L. Brownell, treas.; G. W. Bower, asst. treas. The directors are: Prof. Francis B. Crocker, of Columbia University; Dr. Wheeler, Messrs. Dunn and Doremus, A. Foster Higgins, Herbert Noble, Thomas Ewing, Jr., F. L. Eldridge and C. A. Spofford. The quarterly dividend of 1½ per cent. has been declared and the affairs of the company are in a flourishing condition.

The Los Angeles (Cal.) office of the Westinghouse Electric & Mfg. Co. has been removed to 527 South Main St.

The Kansas City Contractors' Supply Co., St. Louis Ave. and Hickory St., Kansas City, Mo., has been formed to supply complete outfits for contractors, including machinery, tools and equipment for railroad, bridge, paving and building contractors. The officers are: President, K. L. Browne; vice-president, Edward Fenlon; secretary and treasurer, E. H. Browne.

A contract for 800 tons of bridge work for the Fairmont & Clarksburg Traction Co., at Fairmont, W. Va., has been awarded to the Riverside Bridge Co., Wheeling, W. Va. The plans were prepared by the Osborn Engineering Co., of Cleveland, O.

A quarterly dividend (ninth quarter) of 1½ per cent. on the preferred stock of the company, payable Aug. 1, 1905, to stockholders of record May 31, 1905, has been declared by the board of directors of J. G. White & Co., Inc.

G. M. Gest, of New York and Cincinnati, subway contractor, has a large force of men actively at work in Meridian, Miss., installing the conduit system for the Cumberland Telephone & Telegraph Co. at that point. The contract was only awarded to him last week.

R. S. Moore, for 20 years manager of the Risdon Iron Works, of San Francisco, and John T. Scott, for 10 years superintendent of the Union Iron Works, of San Francisco, have formed a new company, called the Moore & Scott Iron Works. They have bought out the National Iron Works of Marshutz & Cantrell, and in addition to the logging and hoisting engine business of the old firm will add mining, dredging, beet sugar, brick and marine machinery departments. They have a finely equipped plant ready for all kinds of machine, boiler and foundry work.

A steel-frame trestle approach, 200 ft. long, will be erected at Frankstown, Pa., for the American Lime & Stone Co. The work is being done by Wm. B. Scaife & Sons Co., Pittsburg, Pa., who also furnished the design for same.

The Abner Doble Co., San Francisco, engineers, has recently secured the contract for the machinery to be installed in an addition to the hydro-electric plant of the Cramer Electric Co., successor to the Idaho Electric Supply Co., at Hailey, Idaho. This contract covers the entire water-power and electrical apparatus and includes a 400-kw. alternator, directly driven by an 800-h.p. set of water wheels, exciter and governor; three-panel marble switchboard; two 25-light arc transformers and 50 arc lamps, with regulators, switchboards and other accessories; 14 transformers and other supplies for the distribution system.

Frank B. Gilbreth, 34 West 26th St., New York, has contracts in progress aggregating over $3,000,000. These include a dam 400 ft. long and 58 ft. high in the Adirondack Mountains, which contains about 150,000 cu. yd. of concrete and is about three-quarters finished; 32 houses, a chimney 150 ft. high, a paper mill, office, power plant and stables at Princefield, in the Adirondacks; a pulp and paper mill, ground wood and sulphite mill, railroad freight terminals and stations, storehouses, machine shops, hydraulic power plant, steam power plant, superintendents' houses, warehouses, hospital, schoolhouse, church, postoffice and complete town, a concrete dam 900 ft. long and 50 ft. high, a concrete hydraulic wall 800 ft. long and 50 ft. high, and a crib wall 500 ft. long for a tail race, all on the American and Canadian banks of the St. Croix River at Spragues Falls, Me. This work was commenced in March last and is to be completed in October. At Montreal there is a large candy factory and power plant for W. M. Lowney; at Dalton, Mass., one mile of pipe line for Ex-Governor Crane; at Stamford, Conn., a tall factory building of steel and brick and reinforced concrete, for the Yale & Towne Co.; at Syracuse, N. Y., car barns and power station for the Bay Road Co., large alterations for the Wetherill Building and the new Sagamore Inn; at Charleston, S. C., the Roper hospital; at Sioux City, a 5-story reinforced-concrete building, covering over an acre, for the Simmons Hardware Co.; for the Latimer Shoe Co., Brooklyn, N. Y., an 8-story, mill construction, brick wall building, which, like the last mentioned, has concrete driven pile foundations; a factory at Oneida Community; a $500,000 residence for C. B. Alexander at 4 W. 58th St., New York, and a number of costly residences in different parts of the country.

PERSONAL NOTES

Mr. Chas. McK. Watts has resigned as principal assistant engineer of the Wabash-Pittsburg Terminal Ry.

First Lieut. Laurence V. Frazier, Corps of Engineers, U. S. A., has been assigned to the military academy at West Point.

Mr. Chas. S. Ferguson has resigned as city engineer of Lorain, O., and Mr. J. B. Nichols has been appointed as his successor.

Capt. James A. Woodruff, Corps of Engineers, U. S. A., has been detailed to enter the staff college at Fort Leavenworth, Kan.

Mr. Wm. E. Maher has been appointed chief of the bureau of highways of Philadelphia, Pa., succeeding Mr. William H. Brooks.

Mr. E. S. Ball has opened an office at 1 Madison Ave., New York, as a contracting engineer for reinforced-concrete and cement-block construction.

Mr. J. K. Howard, engineer of maintenance of way on the eastern division of the Wabash R. R., with headquarters at Peru, Ind., has resigned.

Mr. Paul A. Kirshner has resigned as engineer of bridges of the Chesapeake & Ohio R. R. to accept a similar position with the New York, Weschester & Boston R. R.

Prof. N. C. Ricker, dean of the college of engineering of the University of Illinois, has resigned and will hereafter devote his attention entirely to the architectural department of that college.

Mr. Chas. L. Wachter, of the engineering staff of the Lidgerwood Mfg. Co., of New York, sailed for London, England, July 11, in the interest of his firm, and will remain abroad for several months.

Mr. Charles B. Clark, assistant engineer on the Cleveland, Cincinnati, Chicago & St. Louis R. R., has been appointed chief engineer of maintenance of way of that road, with headquarters in Cincinnati, O.

Mr. C. T. Kinney, formerly supervisor of water softeners for the Chicago & Eastern Illinois R. R., has become connected with the railway and water-softening department of the U. S. Wind Engine & Pump Co., Batavia, Ill.

Mr. Chas. A. Bowman, for several years division engineer on the Metropolitan water-works at Clinton, Mass., has resigned and entered a general engineering practice with Morrison & Farrington, Inc., Dillaye Bldg., Syracuse, N. Y.

The following officers of the Pacific Coast Engineers' Congress were recently elected: George P. Low, San Francisco, president and treasurer; H. H. Sinclair, Los Angeles, vice-president; Samuel G. Reed, Portland, Ore., secretary.

Mr. H. S. Luckman, of the architectural staff of the maintenance of way department of the Southern R. R., with headquarters at Washington, D. C., has resigned to accept a position on the engineering staff of Milliken Bros., of New York.

Mr. C. G. Delo, division engineer of the Chicago Great Western Ry., with headquarters in Des Moines, Ia., has been appointed engineer of maintenance of way on the western division of the Chicago & Alton R. R., with headquarters at Kansas City, Mo.

Mr. N. B. Porter has become general sales manager of the Continental Car & Equipment Co., Whitehall Bldg., New York City. Mr. Porter was formerly associated with the South Baltimore Steel Car & Foundry Co. and the Ryan-McDonald Mfg. Co.

Mr. D. L. Turner has resigned as assistant engineer in charge of station finish for the Rapid Transit Subway Construction Co., New York, and has been appointed general inspector of station design for the Rapid Transit Railroad Commission of New York City.

Mr. Howard S. Reed, assistant engineer in the U. S. Reclamation Service, has been transferred from the Uinta Indian Reservation, Utah, where he has been engaged as hydrographer and assistant engineer since June, 1902, to hydrographic work under Mr. L. C. Hill at Phoenix, Ariz.

Mr. Theodore Paschke has been appointed engineer in charge of stations for the Rapid Transit Subway Construction Co., New York, in addition to his duties as resident engineer on Sections 1, 2 and 3, Contract No. 1, and Section 1, Contract No. 2, of the Rapid Transit Subway in New York.

Mr. Frank C. Dillard has been appointed engineering aid in the U. S. Reclamation Service and directed to report to Mr. J. T. Whistler at Pendleton, Ore. Mr. Dillard is a graduate of the civil engineering department of the University of Oregon and has been engaged in coast and geodetic surveys in California and Oregon.

The construction of the Detroit tunnel line from Windsor, Ont., to West Detroit Yard, Mich., including the electrification thereof, has been placed in charge of an advisory board of engineers, consisting of Mr. William J. Wilgus, vice-president of the N. Y. C. & H. R. R. R.; Mr. Howard Carson, consulting engineer, and Mr. W. S. Kinnear, chief engineer of the tunnel company. The chief engineer will be in direct charge of construction, reporting to Mr. H. B. Ledyard, chairman of the board of directors of the Michigan Central R. R., on executive and financial matters, and to the board of advisory engineers as to plans, specifications and methods of doing the work.

Prof. Leon. H. Rittenhouse, of Brooklyn, N. Y., has been elected professor of engineering in Haverford College, Haverford, Pa., to succeed Prof. L. T. Edwards, who recently resigned. Prof. Rittenhouse is a graduate of Stevens Institute, and has been on the faculty of Armour Institute, Chicago, Ill.

Mr. Collingwood Schreiber, Chief Engineer and Deputy Minister of railways and canals of the Dominion of Canada, has become consulting engineer to the National Transcontinental Railway Commission. He will be succeeded in his present position by Mr. M. J. Butler of the Transcontinental Railway Commission, who will be succeeded by Mr. Duncan MacPherson, Division Engineer of the Canadian Pacific R. R.

A permanent advisory board of engineers has been formed to assist the Geological Survey and the Bureau of Forestry of the U. S. Department of Agriculture in carrying on official tests. The following members have been appointed: Messrs. W. C. Cushing, chief engineer of maintenance of way of the southwestern system of the Pennsylvania lines west of Pittsburg; J. E. Muhlfield, general superintendent of motive power, Baltimore & Ohio R. R.; J. E. Deems, general superintendent of motive power of the New York Central R. R.; James Dun, chief engineer of the Atchison, Topeka & Santa Fe R. R.; D. W. Lum, chief engineer of maintenance of way of the Southern R. R., and Mr. G. H. Buckingham, supervisor of fuel of the New York Central R. R.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Ensley, Ala.—It is reported that the Birmingham Water Wks. Co. will shortly extend its mains to West Ensley.

Carbon Hill, Ala.—See "Power Plants, Gas and Electricity."

Phoenix, Ariz.—Water bonds to the amount of $300,000 were sold on July 3. It is the purpose of the city to construct an entirely new system throughout. Supply will be from wells.

Argenta, (Little Rock), Ark.—See "Power Plants, Gas and Electricity.

Montrose, Colo.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Montrose, on Aug. 28, for the construction of about 8 miles of main distributing canal, for the conveyance and partial distribution of water from Gunnison Tunnel, as advertised in The Engineering Record.

**Colorado Springs, Colo.*—E. W. Case, Engr. San Luis Valley Irrigation, Land & Power Co., writes that contracts have been let as follows for work in connection with dam, etc.: To W. O. Mieir, for embankment; John Stephenson, for concrete, and F. G. Blake, for the tunnel; total cost, $150,000.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Perry, Fla.—Bids will be received until Aug. 1 by the Bd. Water Bond Trus., (John C. Calhoun, Clk.) for $15,000 water bonds.

Chicago, Ill.—Bids will be received until July 28 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.), for furnishing material and constructing a circular concrete lined well 34 ft. internal diameter and 17 ft. deep at the Norwood Park pumping station.

Bids will be received until July 29 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for constructing a brick water tunnel between a point near the existing Peck Court shaft of the 4-mile tunnel system and a shaft located on Jefferson St. about 75 ft. north of Harrison St.

*The Aultman-Taylor Mfg. Co., of Mansfield, O., has secured the contract for furnishing and installing water-tube boilers at 39th St. pumping station on bids opened May 31, for $35,600.

Chicago, Ill.—See "Power Plants, Gas and Electricity."

Moline, Ill.—See "Sewerage and Sewage Disposal."

Columbus, Ind.—Geo. Vorwald, City Clk., writes that the Water Works Com. is investigating the matter of deep-driven wells for the water supply of this city.

Livermore, Ky.—Fred Kollenberg and W. T. Doriot are reported to have secured a franchise for water works.

Owensboro, Ky.—Bids will probably be received about Aug. 30 by the Owensboro Water Co. (Jas. J. Sweeney, pres.) for water works improvements, to cost about $15,000. Engineer, Owen Ford, St. Louis, Mo.

Donaldsonville, La.—E. A. Thibodeaux, City Engr., writes that bids will probably be received in August for water works improvements, to cost $31,000.

Breaux Bridge, La.—The City Council is reported to have decided to issue $25,000 bonds for water works.

Salem, Mass.—The City Clerk writes that the question of increasing the water supply is being investigated, but nothing definite has yet been done.

Grenada, Miss.—See "Power Plants, Gas and Electricity."

Melrose, Minn.—See "Power Plants, Gas and Electricity."

St. Cloud, Minn.—It is stated that bids including plans and specifications will be received until Aug. 7 by H. T. Limperich, City Clk., for a 2,000,000-gal. mechanical filter plant. J. E. Hill, City Engr.

Ruthton, Minn.—Bids will be received until July 27 by the Village Council for $4,000 bonds issued for the purpose of improving the streets and extending the water works. H. E. Martinson, Village Recorder.

Tupelo, Miss.—The citizens are reported to have voted an additional $25,000, to complete the water works and sewerage system.

Utica, Miss.—J. B. Collins, Mayor, writes that bids are wanted at once for water works, to cost about $10,000.

Barnesville, Minn.—The City Clk. writes that the citizens have voted to construct water works at a cost of $40,000.

**Kansas City, Mo.*—Everett Elliott, Secy. Bd. Pub. Wks., writes that the contract for furnishing the annual supply of c. i. pipe and special castings (bids opened June 26) has been awarded to the U. S. Cast Iron Pipe & Fdy. Co.

Jackson, Mo.—No date has yet been set for the opening of bids for the proposed water works for Jackson, as bonds are to be sold first and there may be a short delay waiting the results of sinking an artesian well. There was a previous report that bids would be opened Aug. 1. Hiram Phillips, Engr., 615 Frisco Bldg., St. Louis. Edw. Hays, mayor.

Glendive, Mont.—H. J. Halvorsen, City Clk., writes that about $100,000 will be expended for water works and a sewerage system. Engineer, Edw. S. Baer.

**Items marked thus give the names of parties awarded contracts.*

Arlington, Neb.—The citizens are reported to have voted June 27 to issue $14,000 bonds for the construction of water works.

Winside, Neb.—E. W. Cullen, Chmn. Bd. Water Wks. Trus., writes that bids will not be opened until July 22 for the construction of water works. Previously reported to be opened July 1.

Franklin, N. H.—The City Council is reported to have passed a resolution authorizing the City Treasurer to borrow $20,000 for an additional water supply.

Franklin, N. H.—The City Council is reported to have decided to issue $20,000 bonds for a water supply.

Brooklyn, N. Y.—Bids will be received until July 19 by John T. Oakley, Comr. Water Supply, Gas and Electricity, New York City, for remodeling and extending the Massapequa Pumping Sta., near Massapequa, Long Island, including the pumping plant, pump well, and infiltration gallery system, together with the necessary appurtenances; for furnishing materials and constructing the New Lots Pumping Station, near Blake and New Lots Aves.; also for furnishing, delivering and erecting 3 boilers at said station; bids will also be received same date for furnishing, delivering and laying water mains and appurtenances in 9 streets; also for furnishing and delivering stop-cocks, Boro. Brooklyn.

The Brooklyn Dept. of Water Supply will shortly expend $2,750,000 of the $3,390,000 recently appropriated by the Bd. of Estimate, for the construction of a new conduit from Massapequa, L. I., to Ridgewood reservoir. At Ridgewood the engine house is to be completely remodeled at a cost of $600,000, and several large engines installed. Another $200,000 will be utilized for the extension of the distributing system, and a new driven well plant will be established within the old Brooklyn city limits, to cost about $250,000.

Suspension Bridge, N. Y.—Press reports state that the N. Y. Central & Hudson River R. R. Co. (Henning Fernstrom, Ch. Engr., New York) will construct water works and a 36-stall engine house at this place; probable cost $250,000.

**Utica, N. Y.*—Jos. Dunfee, of Syracuse, is stated to have secured the contract for constructing a pipe line from West Canada Creek to the Trenton Falls dam, a distance of 3½ miles for the Consolidated Water Co.; probable cost, $90,000.

**Newburgh, N. Y.*—The Warren Fdy. & Machine Co., of New York, is stated to have secured the contract on July 3 for water pipe for mains in Liberty and Van Ness Sts., at $25 per ton for 12-in., $26.50 for 8-in., $26.75 for 6-in., and $27 for 4-in. pipe.

The question of installing an electric pump at the high-service pumping station, is reported under consideration.

Turin, N. Y.—L. T. Strong, Village Clk., writes that bids are wanted July 22 for the construction of water works; probable cost, $14,000. Engineer, Sidney Snell, of Lowell. I. L. Smith, Village Pres.

Troy, N. Y.—Engineers Wm. P. Mason, Saml. M. Gray and Geo. W. Fuller have submitted to Comr. of Pub. Wks. Casey their report on the improvements of the water supply, and recommend improvements at the Tomhannock reservoir at an estimated cost of $75,000, and a filtering plant and pumping station at the water works farm, to cost $297,850.

Spencer, N. C.—See "Power Plants, Gas and Electricity."

Asheville, N. C.—A. G. Halyburton, City Clk., writes that the proposed storage reservoir if constructed will cost about $40,000. B. M. Lee, City Engr. A. S. Barnard, Mayor.

Fostoria, O.—C. J. Peters, of Tiffin, has prepared plans for a slow sand filtration plant for Fostoria, to cost $14,000.

Newark, O.—Bids are wanted Aug. 12 for furnishing material and constructing water works, as advertised in The Engineering Record.

Norwood, O.—Bids will be received until Aug. 5 by the Bd. Pub. Service (E. R. Edwards, Clk.) for furnishing material and extending the water mains in the city.

Lancaster, O.—It is reported that bids will be received until July 19 by the Bd. Pub. Service (Geo. Cunningham, clk) for furnishing material and extending the water works. There will be required 6,675 ft. of 6-in. and 1,280 ft. 4-in. c. i. water pipe, 1 ton special castings, 7 fire hydrants, 14 valves and valve boxes, etc.

**Columbus, O.*—Chas. H. Frank, secy. Bd. Pub. Service, writes that the U. S. Cast Iron Pipe & Fdy. Co. has secured the contract for 11,000 tons of 4 to 36-in. c. i. water pipe at $26.50 per ton and 65,000 lbs. special castings at 2⅞ cts. per lb. (bids opened July 5).

Cleveland, O.—The City Council on July 3 passed an ordinance authorizing the issue of $170,000 bonds for installing a high-pressure water service in the downtown district.

Oklahoma City, Okla. Ter.—The Council is reported to have decided to submit to a vote the question of issuing $375,000 bonds for new water works, and an extension of the sewerage system.

Altoona, Pa.—The Water Comrs. are reported to have selected Jos. Sillyman & Co. to make survey of city ground at Kittanning, with a view to constructing one or two reservoirs.

West Chester, Pa.—About $10,000 will be expended for water works improvements. Benj. E. Heston, Chmn. Water Com.

Ashland, Pa.—Bids will be received about Aug. 1 for water works improvements, to cost from $15,000 to $17,000. Engineer, T. Chalkley Hatton, Wilmington, Del.

Jamestown, Pa.—The citizens are reported to have on July 3 rejected the proposition to build municipal water works. It is stated that water works will probably be constructed by a private company.

Wampum, Pa.—See "Power Plants, Gas and Electricity."

Homestead, Pa.—Bids will be received until Aug. 7 by And. Hill, Boro. Clk., for furnishing f. o. b. Homestead 1,200 ft. 6-in. c. i. water pipe.

**Woonsocket, R. I.*—The Builders Iron Foundry, Providence, has secured the contract for a 5,000,000-gal. d'Auria pumping engine for Woonsocket. It will be of the horizontal tandem compound duplex high-duty type, and will pump against a water pressure of 100 lbs. with a steam pressure of 165 lbs. Dean & Main, of Boston, Mass., were the consulting engrs.

Kimball, S. D.—H. C. Smith, City Aud., writes that the National Constr. Co., on June 15, bid for installing an air-lift pumping outfit $2,500.

Charleston, S. C.—The City Council has adopted the report of the committee on water supply and the advisory committee, which report recommends that three experts be employed to investigate the Goose Creek plant, and subsequently Council appropriated the sum of $6,000, if so much be necessary, to meet the expenses of the investigation, and the Mayor was authorized to employ as experts Allen Hazen, J. H. Fuertes and G. W. Fuller, all of New York, N. Y.

Bolivar, Tenn.—See "Power Plants, Gas and Electricity."

Hill City, Tenn.—The Hill City Business League (T. W. Stanfield, Pres.) are reported to have decided to take steps toward organizing a company to construct water works.

Llano, Tex.—See "Power Plants, Gas and Electricity."

Salt Lake City, Utah.—Local press reports state that City Engr. Riter is about to begin survey of the distributing system, to determine the needs of the system to accommodate the increased supply of water; also to give more uniformity of pressure.

St. Johnsbury, Vt.—The Village Trus. are reported to have recommended that a water supply be procured from Halls Pond, in Concord, a distance of 6 miles; probable cost of establishing this system is about $105,000.

Petersburg, Va.—The City Council on July 5 adopted a report recommending extension of sewers to cost $37,000, and water mains to cost about $14,000.

Waukesha, Wis.—The City Council on July 5 adopted a resolution authorizing the Bd. of Pub. Wks. to prepare specifications to be submitted to Council July 18, for the construction of water works. Wm. Powrie, City Engr.

Sheboygan, Wis.—An extension of 2,500 ft. of 16-in. water pipe is to be made by the City Water Co.; also several blocks of smaller sizes.

Cody, Wyo.—Bids will be received at the office of the U. S. Reclamation Service, Billings, Mont., on Sept. 5, for the construction of the Shoshone dam spillway outlet and road tunnels, located 8 miles west of Cody; also on Sept. 6 for the construction of a tunnel and auxiliary works about 10 miles east of Cody, both advertised in The Engineering Record.

Ft. William, Ont.—The question of securing a new water supply is reported under consideration here.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Torrington, Conn.* — The Seymour-Clark-Hills Co., of Springfield, Mass., is stated to have secured the contract for constructing about 1½ miles of sewer for $9,072.

Hartford, Conn.—It is reported that the question of constructing an intercepting sewer along Connecticut River, for the disposal of the sewage of the entire city, is being discussed. Fred. L. Ford, City Engr.

Moline, Ill.—Chas. G. Carlson, City Clk., writes that it is proposed to construct a pipe sewer and a water main in the 5th Ward. Nothing definite done as yet. Clark G. Anderson, City Engr.

Cairo, Ill.—About 8,000 ft. of trunk sewer is to be constructed here. Geo. Parsons, mayor; Richard H. Phillips, consulting engr., 503 Security Bldg., St. Louis, Mo.

Danville, Ill.—J. Torrance, City Clk., writes that it is proposed to construct a storm water sewer on North St. to Stoney Creek, the main sewer to be brick and the laterals of pipe; probable cost $29,000. W. H. Martin, City Engr.

Bartlesville, Ind. Ter.—W. H. Whaley, City Engr., writes that an election will be held Aug. 8 to vote on issuing $17,000 bonds for extending the sewerage system.

Indianapolis, Ind.—Bids will be received until July 19 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for furnishing materials and constructing 10 and 12-in. pipe sewers and appurtenances in portions of Bellefontaine St. and alleys.

Tell City, Ind.—It is reported that contracts will soon be let for the construction of a main sewer in Washington St. Frank Hinkle, City Clk.

Huntington, Ind.—It is stated that bids will be received until July 25 for about 7,180 ft. of brick sewers estimated to cost $25,130. H. H. Wagoner, City Engr.

Perry, Ia.—Bids will be received until July 18 by Adrian Cross, City Clk., for furnishing material and constructing a system of sewers requiring 45,000 cu. yds. of excavation, 54,525 ft. of 8 to 18-in. sewer 5 flush tanks, 57 manholes, etc.; also for constructing an outlet or outfall sewer of vitrified clay sewer pipe or of cement sewer pipe requiring 3,600 ft. 18-in. pipe, 1,600 cu. yds. excav., 7 manholes, etc., also for constructing a sewage disposal plant, the outer walls to be of concrete stone, 7 ft. 8 in. x 46 ft. walls 8-in. thick, laid in good lime cement, side walls 8 ft. high. M. A. Earl, Engr., 1416 First Natl. Bank Bldg., Chicago, Ill.

Lexington, Ky.—Bids will be received until July 22 by Thos. A. Combs, Mayor, for constructing a sewer in a portion of Kentucky Ave.

**Southbridge, Mass.*—Geo. M. Bryne Co., Boston, is stated to have secured the contract for sewers on Union and Cross Sts. for $4,825.

St. Paul, Minn.—Bids were opened by the Bd. of Pub. Wks. July 6 for a sewer to be constructed in Atwater St. D. W. Moore is reported to have submitted the lowest bid for a stone sewer at $24,493, and W. J. Prendergast for a concrete and steel sewer at $18,775.

Bids will be received until July 20 by the Bd. Pub. Wks. (John H. Grode, Pres.), for constructing a sewer in a portion of Whitall St.

The proposed Fairview Ave. sewer, if constructed, will cost $25,645, and will consist of 9,380 lin. ft. 9 to 24-in. pipe and 1,210 lin. ft. brick 26 to 39-in. A. R. Starkey, asst. comr. of Pub. Wks.

Pipestone, Minn.—Bids will be received until Aug. 2 by the Common Council for constructing certain sewers and appurtenances and 2 reinforced concrete septic tanks requiring 11,057 lin. ft. 8 to 18-in. pipe. S. W. Funk, City Recorder.

Tupelo, Miss.—See "Water."

Grenada, Miss.—See "Power Plants, Gas and Electricity."

Glendive, Mont.—See "Water."

Summit, N. J.—Bids are wanted July 18 for the construction of about 8,000 lin. ft. storm sewers from 12 to 24-in.; also 24 manholes, 50 brick catchbasins, etc., as advertised in The Engineering Record.

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. M. A., on Aug. 8, for the construction of storm sewer, surface drainage and sewer systems, as advertised in The Engineering Record.

**Rochester, N. Y.*—Wm. Fuller, 16 State St., is stated to have on July 7 secured the contract for constructing the Blossom, Boule. and Eastern Ave. sewer, for $8,747.

Lake Placid, N. Y.—Bids will be received until Aug. 1 by the Bd. Sewer Comrs. for constructing a trunk sewer approximately 4 miles. F. A. Isham, Counsel Bd. Sewer Comrs., of the Whiteface Inn Sewer Dist., Lake Placid; A. G. Mills, Pres. Bd. Sewer Comrs., 17 Battery Pl., N. Y. City.

Spencer, N. C.—See "Power Plants, Gas and Electricity."

Columbus, O.—Bids will be received until July 25 by the Bd. Pub. Service (Chas. H. Frank, secy.) for constructing sanitary sewers in portions of 2 alleys.

Mansfield, O.—See "Paving and Roadmaking."

Marietta, O.—It is stated that bids will be received until July 24 by the Bd. Pub. Service (A. W. Tompkins, Clk.) for furnishing material and constructing sanitary sewers and drains in Lancaster, Harmar and Matthews Sts.

Columbus, O.—The Council is reported to have passed two ordinances providing for the letting of contracts for the Rennick Run and Jackson Pike sewers, one making provision for $73,000 for the first and another making two provisions for the second, $65,000 and $9,000.

Cincinnati, O.—Bids will be received until July 27 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and constructing sewers in portions of Grand and Hawthorne Aves.

Bids will be received by the Co. Comrs. until Aug. 11 for constructing drains and approaches on E. Miami River road in Miami Township. Eugene L. Lewis, Co. Aud.

Bids will be received until July 24 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and improving a portion of Harris St. by constructing sewers and drains.

Portsmouth, O.—The date of opening of bids for a concrete culvert 12 ft. diam. and 166 ft. long, on 8th St., at Lawson's Run, has been extended from July 8 to July 24. John M. Wendalkin, Clk. Bd. Pub. Service.

Steubenville, O.—It is stated that about 1 mile of 36-in. sewers will be constructed here.

Akron, O.—The City Council is reported to have passed an ordinance providing for the construction of a $40,000 sanitary sewer from the Boulevard to Wolf St., through Lakeside Park.

Shawnee, Okla. Ter.—An election will probably soon be held to vote on issuing $50,000 bonds for a sewerage system.

Reading, Pa.—Ordinances have been passed and approved by the Mayor providing for the construction of house drain sewers, house connections and branches in Dist. Nos. 3½ 4, 5, 6, and 11. It is reported that the probable cost of this work is $750,000. Chas. C. Weltmer, City Clk.

**Altoona, Pa.*—Harvey Linton, City Engr., writes that the contract for the construction of a reinforced concrete storm sewer was on July 8 awarded to Wm. H. Herr for $15,849. Other bidders were: Saupp & Drew, $18,019 and T. H. Bowman, $16,233.

**Carbondale, Pa.*—H. F. Williams, City Clk., writes that P. Moran, of Carbondale, has secured the contract for laying 1½ miles of sewers (bids opened July 10).

**Marion, S. C.*—Engr. A. H. Olmsted, of Marion, writes that Frederic Minshall has secured the contract for constructing a sewerage system for $24,000. All tile pipe to be used with septic tank disposal.

Chattanooga, Tenn.—The Bd. of Pub. Wks. is stated to have decided to construct sewers on William St., from Louisa to Calloway St.

Salt Lake City, Utah.—The Sewer and Special Water Com. of Council is stated to have on July 3 instructed the City Engr. to prepare plans for submission to Council for the enlargement of the sewerage system; about $185,000 will be expended.

Oconto, Wis.—All bids opened on June 17 by the Bd. of Pub. Wks. (W. A. Holt, Chmn.) for furnishing material and constructing sewers have been rejected, and new bids will be received July 18.

Mauston, Wis.—Bids will be received until July 21 for the construction of 3,518 ft. of 12, 24 and 27-in. pipe sewers. G. H. Ely, mayor; W. G. Kirchoffer, engr., Vroman Bldg., Madison.

Items marked thus give the names of parties awarded contracts.

*Gettysburg, Pa.—The following are the bids opened on July 3 for the construction of a sewerage system (Engineer Mason D. Pratt, 18 3d St., Harrisburg); (a) Fehr & O'Rourke, Reading, $30,389 (awarded contract); (b) B. F. Sweeten & Son, Camden, N. J; (c) Geo. W. Ruch & Co., Philadelphia; (d) Bowman Bros., McKeesport, $34,096; (e) Bolton G. Coon, Kingston, $34,923; (f) J. Emory Plank, Gettysburg, $45,775; (g) International Constr. Co., Pittsburg, $41,543; (h) J. U. Fritchey, Lancaster, $37,683; (f) United Ice & Coal Co., Harrisburg, $44,533; (j) Opperman & Bretz, Harrisburg, $37,283.

Terra-cotta pipe, including Y's—	a*	b	c	d	e	f	g	h	i	j
24,700 ft. 8-in., 6 to 8 ft.	$0.54½	$0.78	$0.69	$0.50	$0.56	$0.73	$0.63	$0.56	$0.80	$0.56½
5,900 ft., 8 to 10 ft.	.59½	.94	.77½	.70	.60	.80	.86	.70	.80	.66
1,070 ft., 10 to 12 ft.	.65½	1.05	.94½	1.00	.70	.91	1.05	.80	.80	.83
180 ft., 12 to 14 ft.	.69½	1.28	1.05	1.20	1.20	1.14	1.37	1.00	1.00	1.02
150 ft., 14 to 16 ft.	.74	1.47	1.38	1.50	1.60	1.54	1.37	1.20	1.00	1.24
2,400 ft. 12 in., 6 to 8 ft.	.55	1.00	.93	.75	.75	1.02	.70	.70	.90	.76
1,000 ft., 12 in., 8 to 10 ft.	.60	1.17	1.02	1.00	.75	1.19	.98	.81	1.00	.84
150 ft., 12 in., 10 to 12 ft.	.66	1.28	1.12	1.30	1.00	1.48	1.17	1.00	1.00	1.02
2,550 ft. 15-in., 6 to 8 ft.	.58	1.09	1.15¼	1.00	1.00	1.31	.78	.81	1.20	.99
450 ft., 15 in., 8 to 10 ft.	.62	1.32	1.24	1.20	1.20	1.48	1.20	1.00	1.20	1.24
10,000 ft. 4-in. house connections	.39	.50	.45	.25	.35	.46	.80	.50	.40	.57
300 ft. 3-in. drain tiles	.22	.20	.10	.15	.30	.14	.06	.10	.15	.05
60 standard manholes	39.00	43.50	37.50	50.00	34.00	51.20	42.00	60.00	60.00	42.00
20 ft. extra depth below 10 ft.	4.10	4.00	4.00	6.00	3.00	7.40	3.00	3.50	...	1.60
6 drop manholes	42.00	60.00	45.00	60.00	45.00	64.00	42.00	65.00	60.00	42.00
10 ft. extra depth below 10 ft.	4.10	4.50	5.00	8.00	4.00	7.40	3.00	4.50	...	1.60
6 standard flushtanks	34.40	85.00	70.00	75.00	80.00	79.50	48.00	100.00	60.00	95.50
54 lamp holes	5.71	8.00	12.00	10.00	4.00	17.00	10.00	15.00	6.00	11.50
72 ft. 12-in., No. 76 c. i. pipe	1.04	5.00	1.40	2.00	1.20	2.30	1.90	1.50	3.00	...
36 ft. 16-in., No. 120 c. i. pipe	1.35	5.00	2.40	3.50	1.70	4.00	3.00	2.00	4.00	...
50 cu. yds rock excavation	2.00	4.00	2.75	2.90	2.25	3.00	2.50	3.00	1.50	.78
1 concrete septic tank, complete	$1,283	$3,700	$1,732	$2,500	$2,600	$3,053	$1,800	$2,475	$2,863	$2,342

*Altoona, Pa.—Harvey Linton, City Engr., writes that the following are the bids opened by the Bd. of Pub. Wks. on July 7 for constructing the Millville sewers: (a) W. H. Herr; (b) Saupp & Drhew (awarded contract; (c) Jos. P. Harney; (d) Isaac Bender; (e) Thos H. Bowman; (f) J. T. Finn; (g) Chas. B. Clark:

Pipe Sewers—	a	*b	c	d	e	f	g
18,570 ft. 8-in.	$1.00	$0.75	$0.93	$0.69	$0.77	$0.80	$0.70
2,240 ft. 10-in.	1.00	.84	.93	.69	1.00	2.37	.80
380 ft. 12-in.	1.20	.97	.93	.69	1.50	2.60	1.00
4,380 ft. 15-in.	1.50	1.24	1.48	1.50	1.75	22.85	1.70
34 air inlets	8.00	6.50	8.00	8.00	7.50	6.75	6.50
30 manholes	40.00	50.00	73.00	40.00	45.00	32.50	55.00
2,000 ft. 4-in. tile	...	.05	.10	.07	.20	.12	..
2,000 ft. 6-in. tile	...	.07	.12	.10	.25	.12	.10
250 cu. yds. concrete	...	7.50	6.00	10.00	7.00	2.00	5.00
Total	$31,282	$25,345	$31,591	$25,503	$29,029	$55,640	$26,621

*Seattle, Wash.—The following are the bids opened on July 1 by the Bd. of Pub. Wks. for constructing sewers in 2d Ave. W. and other streets (bidders all of Seattle): (a) Stirrat & Goetz; (b) David Dow & Co.; (c) Krough & Jessen (awarded contract); (d) T. I. Peterson; (e) J. A. Bailey; (f) F. Ryan:

	a	b	*c	d	e	f
Fixed estimate	$1,200.00	$1,200.00	$1,200.00	$1,200.00	$1,200.00	$1,200.00
Pipe sewers—						
8,180 lin. ft. 8-in.	.95	.88	.80	1.00	1.00	.90
2,500 lin. ft. 10-in.	1.05	1.05	1.05	1.15	1.25	1.00
1,680 lin. ft. 12-in.	1.25	1.20	1.20	1.40	1.30	1.25
1,360 lin. ft. 15-in.	1.55	1.65	1.60	2.25	1.75	1.40
830 lin. ft. 18-in.	2.00	2.10	2.10	3.75	2.30	2.25
1,090 lin. ft. 21-in.	2.45	2.70	3.00	4.10	2.85	2.90
57 4½-ft. manholes	60.00	70.00	65.00	60.00	60.00	60.00
6 flushtanks	90.00	95.00	90.00	90.00	90.00	90.00
30 catchbasins, double inlets	65.00	70.00	67.00	75.00	65.00	70.00
60 catchbasins, single inlets	60.00	60.00	55.00	65.00	60.00	60.00
20 cu. yds. concrete	.50	5.00	10.00	5.00	.01	.01
Total	$29,654	$30,329	$29,131	$35,458	$31,595	$29,754

BRIDGES.

Notes Arranged Alphabetically by States.

Denver, Colo.—Bids will be received until July 29 by T. W. Jaycox, State Engr., Denver, for constructing a steel bridge across Purgatory River at Sopris to have a 125-ft. span.

Hartford, Conn.—Plans and specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the foundations and substructure; also for the superstructure of a highway bridge over tracks of Central New England Ry., at Albany Ave.; also for grading about 1,800 lin. ft. of new highway on Albany Ave.; bids for which willl be received by the Bd. of Street Comrs. on July 19, as advertised in The Engineering Record of July 8. Fred. L. Ford, City Engr.

Danville, Ind.—It is reported that bids will be received by the Co. Comrs. until July 31 for constructing concrete arches in Brown and Center Townships. David D. Mills, Co. Aud.

Lowell, Mich.—The citizens are stated to have voted to issue $12,000 bonds for constructing 3 steel bridges to replace ones recently destroyed.

**Ada, Mich.*—The contract for constructing a steel bridge over Grand River here is stated to have been awarded to the Massillon Bridge Co., of Massillon, O., for $7,544.

Whitehall, Mich.—Bids will be received until July 28 by the Village Council for a 75-ft. steel bridge with 20-ft. roadway and 5-ft. sidewalk to have plank or concrete top. Address Village Clk.

Ellisville, Miss.—See "Paving and Roadmaking."

Perth Amboy, N. J.—Bids will be received until July 26 by the Bd. Chosen Freeholders at New Brunswick for erecting three 150-ft., steel spans to the Amboy Bridge, a highway bridge across the Raritan River between Perth Amboy and Sayreville, as advertised in The Engineering Record.

New York, N. Y.—The Bd. of Estimate on July 7 approved the plans of Geo. E. Best, Comr. Dept. of Bridges, for the new Manhattan terminal for the Brooklyn Bridge. The structure will cost $3,000,000 and will extend from the southerly line of the present bridge property along the easterly line of Centre St., to the southerly line of Pearl St. The plans provide for a station east of Centre St. and south of Duane St., and for extension of present bridge tracks and laying new tracks into the bridge station and on to Pearl St. for switching and loading purposes.

**Elmira, N. Y.*—The contract for constructing Lake St. bridge (bids opened June 15) has been awarded to the American Bridge Co., of New York, for $45,818, work to be completed on or before Nov. 5, 1905. The bridge will consist of 3 spans of 184 ft. each, with concrete arch floor 24 ft. wide, paved with brick, and two sidewalks 8 ft. wide of plank. The present piers will be lengthened.

Bids will be received on Aug. 1 by the Lake Street Bridge Comn. (Jervis Langdon, Secy.) for the purchase of the metal work of the present Lake St. bridge, as advertised in The Engineering Record.

Bloomington, Neb.—It is stated that bids will be received until July 24 by John Parker, Co. Clk., for constructing a 2-span steel bridge across Republic River at Naponee.

Buffalo, N. Y.—Bids will be received by the Dept. Pub. Wks. (Francis G. Ward, Comr.) until July 20, for constructing substructure of bridge on River St., over slip No. 1; separate bids will also be received same date for moving Scott St. bridge to proposed abutments on River St.

Chicago, Ill.—The following are the bids opened on June 27 for constructing the substructure of a highway bridge at Southwestern Ave.: (a) Thos. P. McDonough; (b) Chicago & Great Lakes Dredge & Dock Co.; (c) Rudolph S. Blome Co.; (d) John O'Brien; (e) Roemheld & Gallery Co.; (f) Hayes Bros. Co.; (g) Jackson & Corbett Co.:

	a	b	c	d	e	f	g
Removing old bridge	$400.00	$1,690.00	$1,300.00	$800.00	$5,000.00	$500.00	$1,500.00
Cement house, etc.	1,000.00	650.00	450.00	300.00	675.00	1,100.00	850.00
20,000 cu. yds. excav.	.90	.90	1.25	1.75	1.75	.90	1.35
20 M. ft. oak planks for lining on abutments, etc.	44.00	50.00	45.00	40.00	55.00	60.00	47.00
25 M. ft. white pine for sidewalk	33.00	35.00	34.00	35.00	25.00	40.00	38.50
2,100 cu. yds. Portland cement concrete	5.25	5.90	6.48	6.00	5.25	7.75	7.90
34 cu. yds. Bedford coping stone	24.00	20.00	18.00	15.00	10.00	25.00	21.00
760 lin. ft. curb	.60	.70	.80	.75	.25	.90	.80
2,000 cu. yds. fill for approaches	.18	.35	.40	.75	.25	.75	.40
1,600 sq. yds. cedar block pavement	1.30	1.50	1.26	1.35	1.25	2.00	1.59
2,650 lbs. steel I-beams	.03½	.03¾	.03¼	.03	.03	.05	.03½
18,000 lbs. corrugated steel bars	.04	.04	.036	.03	.02½	.05	.03¾
50 lin. ft. new brick, part of 3-ft. sewer	9.00	6.00	5.00	9.00	3.00	5.00	9.00
10 lin. ft. new brick, part of 6-ft. sewer	16.00	9.00	11.00	20.00	9.00	12.00	11.00
Totals	$20,273	$23,026	$23,928	$24,164	$24,734	$28,431	$28,690

Dayton, O.—Bids will be received until July 27 by the Co. Comrs. of Montgomery County, at Dayton, for furnishing material and constructing a bridge across Big Twin Creek on the County line between Jackson Township, Montgomery County, and Lanier Township, Preble County. Bids are to be submitted separately on the superstructure, which is to consist of 2 spans each 150 ft. long, of a high truss steel bridge, 16 ft. roadway, capacity 125 lbs. per sq. ft.; substructure, including 2 abutments and wing wall and pier, north and south approach. Plans and specifications are to be submitted by the bidders for the superstructure. T. J. Kauffman, Co. Aud.

**Zanesville, O.*—The Bd. County Comrs. is stated to have awarded the contract (bids opened June 15) for constructing protection cribs to draw pier of bridge over Muskingum River, near mouth of Burch Creek, to Clifton Bros., for $14,444.

Cleveland, O.—Bids will be received until July 29 by the Co. Comrs. for constructing steel bridges and masonry abutments and culverts in Bedford Township. Julius C. Dorn, Co. Clk.

Mansfield, O.—See "Paving and Roadmaking."

**Fossil, Ore.*—H. F. C. Heidtmann, Co. Surv., writes that the contract for constructing a bridge over John Day River (bids opened July 5) has been awarded to Portland Bridge & Bldg. Co., of Portland, for $6,250.

Nashville, Tenn.—The question of constructing a bridge across Cumberland River is reported under discussion here.

St. John, N. B.—See "Railroads."

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

**Ft. Rosecrans, Cal.*—Capt. R. H. Rolfe, Q. M., U. S. A., San Diego, writes that the contract for construction of roads, sidewalks, gutters, etc., at Ft. Rosecrans (bids opened June 22) has been awarded to Jas. McNair of San Bernardino, for $18,978.

Waterbury, Conn.—It is reported that bids will be received on July 18 at Waterbury (not Watertown, as previously stated) for paving Grand and N. Willow Sts. with brick, about 6,250 sq. yd. Robt. A. Cairns, City Engr.

Morris, Conn.—Bids will be received until July 18 by the Bd. of Selectmen (Geo. H. Johnson, 1st Selectman) for grading and constructing a section of road in this town.

Hartford, Conn.—It is stated that the estimated cost of constructing a macadam road from Farmington to the West Hartford line is about $27,000.

Washington, D. C.—Bids will be received by Lieut. Col. Smith S. Leach, Corps Engrs., U. S. A., on Aug. 4, for constructing macadam roadways on approaches to highway bridge across Potomac River, as advertised in The Engineering Record.

Jacksonville, Fla.—Roland Woodward, Civil Engr., is stated to have submitted to the Bd. of County Comrs. estimates for constructing a road from Jacksonville to the sea, as follows: The estimate of $100,380 is for what is known as the direct route, which lies a little north of the railroad track, and runs through considerable low land. The estimate for the river route, passing through a number of settlements along the line of the old Mayport Railroad, shows that the cost for a hard-surface paved road is $119,280.

**Quitman, Ga.*—M. C. Wade, City Clk., writes that the West Constr. Co., of Chattanooga, Tenn., has secured the contract for vitrified brick pavement on concrete foundation at $2 per sq. yd., and for cement sidewalk $1.25 per sq. yd.

**Peoria, Ill.*—The Barber Asphalt Co. on July 10 secured the contract for resurfacing Moss Ave. with asphalt, about 20,500 sq. yd., for $21,911. The McCarthy Constr. Co. bid for this work, $25,900.

**Monticello, Ill.*—The contract for paving the city square is stated to have been awarded to Morrissy & Porter, of Paris, at $1.47 per sq. yd.

Freeport, Ill.—Bids are wanted July 19 for grading, curbing and macadamizing Elk St., as advertised in The Engineering Record.

Jacksonville, Ill.—It is proposed to pave Findley St. with brick, at a cost of $6,500.

Martinsville, Ind.—It is stated that bids will be received until Aug. 7 by the Co. Comrs. for constructing 14½ miles of gravel road in Clay Township; also 4 miles of rock road in Ashland Township. Earle O. Gilbert, Co. Surv.

**Paoli, Ind.*—Alvin B. Ham, Co. Aud., writes that O. P. Turley, of Orleans, has secured the contract for constructing 3 miles of road (bids opened July 5) for $8,500.

**Logansport, Ind.*—Carney & Wilber are stated to have received the contract for constructing 2 gravel roads in Jackson Township for $2,399 and $11,789, respectively. (Bids opened July 5.)

Peru, Ind.—It is stated that the Comrs. of Miami County will soon receive bids for constructing a gravel road on the county line; C. W. Macy, Co. Aud.

Worthington, Ind.—It is stated that the Town Bd. is receiving bids for constructing cement sidewalks on a portion of Dayton St.

Bluffton, Ind.—It is stated that bids will soon be received for paving with asphalt South St.; also for constructing cement sidewalks.

**Logansport, Ind.*—The Western Constr. Co. has secured the contract for paving North St. with bitulithic at $1.60 per sq. yd. for 14,071 sq. yds. and 60 cts. per ft. for 6,674 ft. cement curb and gutter.

Danville, Ind.—It is reported that bids will be received until July 31 by the Co. Comrs. for constructing 22,992 ft. of gravel roads; David D. Mills, Co. Aud.

Columbus, Ind.—It is reported that bids will be received until July 20 by Geo. Vorwald, City Clk., for paving with asphalt on a portion of Washington St.

Indianapolis, Ind.—Bids will be received until July 24 by the Bd. Pub. Wks. (M. A. Downing, Chmn.) for grading and paving with cement sidewalks on a portion of Bright St.

It is stated that bids will soon be received for paving with brick and constructing cement walks on a portion of Meridian St.; also for paving with bitulithic pavement on a portion of Tuxedo St.

The Hoosier Constr. Co., Fitzgerald Bldg., is stated to have received the contract for paving with Warren's bitulithic pavement on Northwestern Ave., at $3.11 per lin. ft.

**Items marked thus give the names of parties awarded contracts.*

Monticello, Ind.—It is reported that bids will be received until July 31 by the Co. Comrs. for constructing the Weaver gravel road in Honey Creek Township; J. L. Jackson, Co. Aud.

Des Moines, Ia.—Bids will be received by the Bd. Pub. Wks. (W. W. Wise, Chmn.) until July 22 for grading Greenwood Lane from Ingersoll Ave. to Woodland Ave., in all about 4,579 cu. yds. and also on July 29 for grading Park Lane from Grand Ave. to Woodland Ave., about 2,750 cu. yds.

The following are the bids opened July 8 for paving W. Walnut St. from 2d to 9th Sts. with asphalt, 15,560 sq. yds.: Wm. Horrabin, Iowa City, $1.99½; Cleveland Trinidad Paving Co., Cleveland, O., $1.92; Barber Asphalt Paving Co., $1.66; McCarthy Improv. Co., Davenport, $1.73, and O. P. Herrick, $1.97.

**Lawrence, Kan.*—Holland Wheeler, City Engr., writes that J. H. Maxwell, of Topeka, has secured the contract for 13,500 sq. yds. macadam pavement (bids opened July 3) at 43 cts. per sq. yd. J. Nicholson, of Lawrence, secured the contract for furnishing and setting stone curb, 6 in. thick, at 43½ cts. per ft.

Atchison, Kan.—The Council on July 3 passed ordinances providing for the paving of Kansas Ave. with 18,356 sq. yds. brick paving on old concrete foundation, cement fill, and for paving Spring St. with brick, 6,485 sq. yds. and 4,500 lin. ft. cement curb; Fred Giddings, City Engr.

**Louisville, Ky.*—The Bd. Pub. Wks. is stated to have awarded to American Standard Asphalt Co., 1st and A Sts., the contract for resurfacing with asphalt 4 blocks of streets at from $1.34 to $1.39 per sq. yd.

Cumberland, Md.—Bids will be received until July 25 by the County Road Directors at Cumberland (D. F. McMullen, Chmn.) for improving the public highway between Corrigansville and Barrelville, requiring the grading and macadamizing of about 1 mile of road.

Centreville, Md.—Bids will be received until July 25 by the Co. Comrs. (Jos. M. Parvis, Clk.) for macadamizing the highway between Sudlersville and Dudley's school, in all about 2 miles.

Springfield, Mass.—Bids will be received until Aug. 3 by Arthur A. Adams, Supt. of Streets, for laying about 12,000 sq. yds. of bitulithic or bituminous macadam pavement. Chas. M. Slocum, City Engr.

Lansing, Mich.—Plans and specifications have been adopted for the paving of Capitol Ave. and Grand, Walnut and Washtenaw Sts., about 12,144 sq. yds. H. A. Collar, city engr.

Detroit, Mich.—The following bids are stated to have been received July 3 for paving: Lennane Bros., 40 Fort St., W., for 25th St., $4,974, Wesson Ave., $13,007; Robt. Conway & Co., for Livingston Ave., $7,026, Brady St., $13,791; Michigan Contr. Co., for Hobart Ave., $2,129; Jos. Conn & Co., for Locust St., $7,829. Paving with brick furnished by the city portion St. Aubin Ave., Jas. W. Hanley, 40 Fort St., W., $3,147, with brick St. Antoine St., $9,920.

**Muskegon, Mich.*—P. P. Misner, City Recorder, writes that the Elk Cement & Lime Co., of Petosky, has secured the contract for 3,500 cu. yds. crushed stone (bids opened June 3).

St. Paul, Minn.—The Com. on Streets of the Bd. of Aldermen is stated to have recommended to Council the awarding of the contract for macadamizing a portion of Arcade St. to W. J. Prendergast; his bid was $6,500.

Ruthton, Minn.—See "Water."

Grenada, Miss.—See "Power Plants, Gas and Electricity."

Ellisville, Miss.—Bridge and road bonds amounting to $20,000 are reported sold.

Hoboken, N. J.—It is stated that bids will be received until July 26 by the Mayor and Council for repaving Jefferson and 7th Sts. with Belgian block. Jas. H. Londrigan, City Clk.

Orvil, N. J.—Bids will be received until July 22 by the Boro. Council at the Mansion House, Hohokus, for curbing, grading, guttering and macadamizing with necessary pipes, culverts and catch basins on 5 streets in the Boro. of Orvil. Edwin West, Jr., Mayor, Hohokus; Richard T. Dana, Boro. Engr., 15 William St., N. Y. City.

Elizabeth, N. J.—Bids are wanted Aug. 1 for paving Jefferson Ave., to consist of 6,398 sq. yds. asphalt pavement, depressed block foundation; 556 sq. yds. asphalt, 3½ in. thick, and 3,876 sq. yds. block pavement relaid on concrete base, tar and gravel fill; also same date for paving Anne St. 1,765 sq. yds. asphalt, concrete base, resetting curb, headers, etc.; W. H. Luster, Jr., City Surveyor.

**West Hoboken, N. J.*—The Bd. of Council is stated to have awarded the contract for paving with Belgian blocks on Lake St. to Callery & Murphy for $7,012.

New York, N. Y.—The lowest bid opened July 6 by the Dept. of Parks for repairing asphalt pavement was submitted by the Barber Asphalt Paving Co., 114 Liberty St., for $8,622.

Buffalo, N. Y.—Bids will be received until July 21 by the Dept. Pub. Wks. (Francis G. Ward, Comr.), for repaving a portion of Sycamore and Elk Sts.

*The Ganz-Wilson Constr. Co. is stated to have received the contract for paving with brick portions of Stanislaus and Harmonia Sts. for $9,920 and $8,593 respectively.

John Seibert is stated to have submitted the lowest bid July 7 for repairing asphalt paved streets for fiscal year 1905-'06.

**Utica, N. Y.*—The Barber Asphalt Paving Co., 131 Broad St., is stated to have received the contract for paving portions of Jason, Mary and Miller Sts., Cottage Pl., Addington Pl., Sunset and Lincoln Aves., for $33,043.

Johnstown, N. Y.—The Council on July 10 passed a resolution providing for the paving of Market St. from Washington to Montgomery Sts., with asphalt block. J. F. Campbell, City Engr.

**Akron, O.*—The Bd. of Pub. Service is stated to have awarded contracts as follows: Paving Hall St. to J. M. Davidson, $5,066; for paving Beck Ave. to S. W. Parshall for about $5,500.

It is stated that bids will be received until July 28 by the Bd. Pub. Service for paving a portion of Howard St. with sheet asphalt. It is stated that bids on maintenance will also be received. J. W. Payne, City Engr.

Mansfield, O.—It is reported that bids will be received until July 28 by D. S. Koontz, City Aud., for $25,000 street improvement bonds.

Bids will be received until July 27 by the Bd. Pub. Service for furnishing material and paving with brick, sheet asphalt or bitulithic about 10,700 sq. yd. on Mulberry St., constructing concrete culvert at E. 3d St., requiring 700 cu. yd.; constructing brick and concrete arch bridge and retaining walls at Cline Ave., span 12 ft., length 20 ft., and constructing 4,000 ft. of 8-in. sanitary sewer in Park Ave. E (N. side).

Columbus, O.—Bids will be received until July 25 by the Bd. Pub. Service (Chas. H. Frank, secy.) for paving and repaving portions of several streets.

**Woodville, O.*—The following are the bids opened July 3 for paving Maumee Pike with brick: (Engineer, John C. Overmeyer, Fremont) J. F. Gantz, Bowling Green, $22,836; Kerlin Bros., Toledo, $18,476; Woodville Lime Co., Woodville, $20,444.15; Hanlon Construction Co., Cleveland, $19,673 (awarded contract for Athens block); A. Witte, Elmore, $20,059; F. W. Hill, $21,096.

**Canton, O.*—The contract for paving with vitrified block on Mahoning St. is reported to have been awarded to Corl, Downs & Campbell for $28,596 (bids opened June 19).

Calvin and Wm. Turnbull are stated to have received the contract for improving E. 4th St. for $14,116.

**Cincinnati, O.*—The following bids are reported to have been received for improving a portion of Linwood Ave. with bitulithic: Warren Bros. Co., $168,305 (awarded contract); Kirchner Contr. Co., $171,036; and Henkel & Sullivan, Rodmann Bldg., $172,864.

Bids will be received until Aug. 11 by the Co. Comrs. for improving Riddle Road in Springfield Township and repairing Deerfield Road in Columbia Township; Eugene L. Lewis, Co. Aud.

Panama.—Bids will be received until Aug. 5 by the Isthmian Canal Comn. (D. W. Ross, Gen. Purchasing Officer), at Washington, D. C., for furnishing 4,000,000 paving brick.

Butler, Pa.—Bids will be received until July 18 by the Town Council (H. E. Coulter, Secy.) for grading, curbing and paving on portions of W. Clay, New Castle and E. Pearl streets.

Greensburg, Pa.—Bids will be received until Aug. 7 for paving on Joe St. with vitrified brick, including grading and curbing.

Dorranceton, Pa.—Bids will be received until July 22 by the Town Council for grading, curbing and paving with brick and macadam on a portion of Market St.; Geo. Van Buskirk, Chmn. Street Com.

Indiana, Pa.—Bids will be received until July 22 by the State Highway Dept. at Harrisburg, for constructing 31,400 ft. of road extending from the Boro. line of Saltsburg to the line between Conemaugh and Young Townships at Clarksburg, in Conemaugh Township; also 2,605 lin. ft. brick paving and 1,702 lin. ft. macadam in the Boro. of Saltsburg, County of Indiana.

Allentown, Pa.—Bids are wanted July 18 for paving Liberty, Jefferson and Madison Sts., about 32,791 sq. yds., as advertised in The Engineering Record.

Ingram, Pa.—Bids will be received until July 18 by John McBride, Rm. 46 Fidelity Bldg., Pittsburg, for grading, curbing and paving McKee St. in Ingram; approximate quantities, 1,800 cu. yds. grading, 1,500 ft. curbing and 1,700 sq. yds. paving.

Southampton, Pa.—Bids will be received until July 24 by the Superv. of Southampton Township at the office of Jos. W. Hunter, State Highway Comr., Rm. 536, 1011 Chestnut St., Philadelphia, for constructing 20,500 ft. of road extending from Trevose to Southamptonville in Southampton Township.

**Emlenton, Pa.*—J. Hanna, Jr., of Franklin, has secured the contract for brick paving (bids opened July 5). He bid for 9,275 sq. yd. brick paving on gravel foundation, $1.46½; 4,652 lin. ft. sandstone curb, 55 cts., and 20 catch basins, each, $16.10. H. J. McKinley, Boro. Engr., Harrisville, Pa.

Nashville, Tenn.—An election will probably soon be held to vote on issuing $500,000 bonds for paving.

Petersburg, Va.—The Public Improvement Com. is stated to have submitted a report on street roadway improvement, which recommends the macadamizing of nearly every unpaved street in the city, aggregating in cost several hundred thousand dollars.

**Bellingham, Wash.*—Chas. E. Lind is stated to have received the contract for improving with macadam 14th St., for $7,642.

**Milwaukee, Wis.*—The Bd. of Pub. Wks. is stated to have awarded to Wm. Guthnecht, 1069 8th Ave., the contract for paving about 9,040 sq. yds. on Clybourn St. with Kettle River sandstone, at $2.92 per sq. yd.

New Brighton, S. I., N. Y.—The following are the bids opened on June 27 by Geo. Cromwell, Pres. Richmond Boro., for paving Maine Ave., Ohio Pl., New York Ave., and other streets; (*a*) Jos. Johnson's Sons, West New Brighton; (*b*) John F. Donovan, West New Brighton; (*c*) John E. Donovan, Port Richmond; (*d*) R. C. Fountaine, 209 W. 108th St., New York City:

	a	*b*	*c*	*d*
6,450 cu. yds. excav.	$0.45	$0.42	$0.40	$0.38
10 cu. yds. steel concrete	12.00	15.00	15.00	10.00
1,500 lin. ft. 4-in. underdrain	.25	.15	.20	.09
18,350 sq. yds. macadam pavement	.82	.76	.78	.72
5,000 sq. yds. vit. brick pavement	1.90	1.87	1.88	1.80
850 sq. yds. old brick pavement, relaid	.60	.50	.50	.70
750 cu. yds. concrete	4.75	4.70	4.75	4.00
650 lin. ft. new curb	1.20	1.25	1.00	.75
Total	$32,905	$31,256	$31,497	$29,088

**Rock Island, Ill.*—Wallace Treichler, City Engr., writes that the following are the bids opened June 28 for paving 14th Ave. with brick (bidders all of Davenport, Ia.): Davenport Constr. Co.; McCarty Improv't Co.; Tri-City Construction Co.,* (awarded contract):

	a	*b*	**c*
36,700 sq. yds. 6-in. macadam base brick pavement	$1.44	$1.43	$1.39
10,680 sq. yds. 5-in. concrete base brick pavement	1.58	1.56	1.53
11,250 lin. ft. sandstone curb	.49	.48	.47
6,460 cu. yds. excav. (extra)	.28	.25	.25
2 catchbasins	85.00	82.00	75.00
80 lin. ft. 36-in. culvert pipe	4.40	4.45	4.35

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Carbon Hill, Ala.—It is stated that bids will be received until July 24 for $25,000 water works and electric light plant bonds. Edgar B. Kay, engr., Tuscaloosa, Ala.; J. S. Shannon, chmn.

Ensley, Ala.—The Street and Light Com. of Council is reported to have agreed to recommend to the Mayor and Bd. of Aldermen the construction of an electric light plant.

Birmingham, Ala.—A building permit has been issued to the Birmingham Ry., Light & Power Co. to erect a new gas holder, to cost $52,000.

Argenta (Little Rock), Ark.—The citizens are reported to have petitioned Council to establish water works and an electric light plant.

**Denver, Colo.*—The Onderdonk Eng. Co. is reported to have secured the contract for installing 2 boilers in the city hall and removing the old ones, for the purpose of lighting and heating, for about $5,000.

Washington, D. C.—Bids will be received until July 25 at the Bureau Supplies and Accounts, Washington, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Electrical supplies; cable; frogs and switches, c. i. pipe and specials; hydrants; ventilating sets; reconstructing coaling plant; traveling hoist; dredging; Portland cement; sheet copper; pressure gauges, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Calhoun, Ga.—Geo. C. Chambers, of Calhoun, writes that he will construct an electric light plant, to cost from $3,500 to $4,000, and operate it with water power.

Monroe, Ga.—Bids will be received until July 31 by the Mayor and Council for machinery and material and installing complete an electric light plant embracing two 66x18-in. high-pressure boilers, a 175-hp. Corliss engine, a 120-kw. a. c. generator, 15 arc and 40 50-cp. street lights, 900 light transformers, capacity and pole line. J. B. McCrary, Engr., Senoia, Ga.; address W. H. Nunnally, Chmn. of Council.

Chicago, Ill.—The Chicago & Suburban Water & Light Co. has accepted the offer suggested by Mayor Dunne that the city purchase its plant at Austin for $250,000, and an ordinance for the purchase of the system has been introduced in Council.

Bids will be received until July 21 by Wm. Carroll, City Electrician, for furnishing and delivering on Sheffield Ave., Halsted, 35 and 57th Sts., 24,000 duct ft. (more or less) of tile or cement conduit, 3,300 ft. of 2½-in. steel pipe and 58 manhole castings.

Indianapolis, Ind.—The Cheney Electric Co. is reported to have secured the contract for the electric wiring and fitting for the new State Industrial School for Girls to be located on Crawfordsville Pike, for $9,178.

Indianapolis, Ind.—The City Council has passed an ordinance ratifying the new franchise for the People's Light & Heat Co., which will succeed the Home Htg. & Lighting Co.

Tell City, Ind.—It is reported that bids will be received by Frank Hinkle, City Clk., for new machinery to be installed at the electric light plant.

Shelbyville, Ind.—See "Electric Railways."

Sioux City, Ia.—The Sioux City Gas & Electric Co. (L. L. Kellogg, gen. mgr.) is reported to have purchased property on Court and Iowa Sts., and will erect within the next year or two, a new retainer having a capacity of about 1,000,000 cu. ft.

Abbeville, La.—Bonds to the amount of $40,000 have been sold, to be used for water works, sewerage and electric lights.

**Holyoke, Mass.*—The Holyoke Water Power Co. is reported to have awarded to Prentiss, Brooks & Co. the contract for a quantity of cement for concrete work, and to the Walsh Boiler Wks. for three 11-ft. steel penstocks. Contracts for the buildings, water wheels and electrical and steam apparatus have not yet been let.

**Melrose, Minn.*—Contracts for constructing an electric light plant and water works (bids opened June 29) have been awarded as follows: To the Dwyer Plumbing & Htg. Co., of St. Paul, for plant complete, except electric portion, for $27,225, and to the American Electric Co., of St. Paul, for the electrical portion, for $6,644. Engineer, Oscar Claussen, St. Paul.

Durant, Miss.—J. G. Hamilton, Mayor, writes that bids are wanted Aug. 1 for the construction of an electric light plant for which $10,000 bonds are to be issued.

Grenada, Miss.—The citizens are reported to have voted to issue $30,000 bonds to extend sewerage system, improve water and light plant and lay concrete pavements.

New York, N. Y.—Bids will be received until July 24 by C. B. J. Snyder, Supt. School Bldgs., Dept. of Educ., for installing electric equipment in School No. 10, Boro. Bronx.

**Items marked thus give the names of parties awarded contracts.*

Lockport, N. Y.—The American District Steam Co. is reported to have petitioned Council for a franchise to use the city streets and supply light, heat and power in Lockport.

Cairo, N. Y.—The Cairo Electric Light & Power Co. has been incorporated with a capital of $80,000 to manufacture and supply light in Cairo; F. G. Walters, of Cairo, is one of the directors.

Paul Smiths, N. Y.—The Paul Smiths Electric Light & Power Co. is reported incorporated with a capital of $100,000 by Paul and Phelps Smith.

**Brooklyn, N. Y.*—The Commercial Constr. Co., 1 Madison Ave., New York, has secured the contract for electric equipment of School 110, Brooklyn Boro. (bids opened July 10) for $9,769.

Charlotte, N. C.—The Southern Power Co., with officers in the Trust Bldg., has been incorporated to develop the water power of Catawba River, N. C., and the Wateree River in S. C. Dr. W. G. Wylie, pres., 28 W. 40th St., New York, N. Y.; W. T. Martin, Jr., asst secy., Charlotte.

Greensboro, N. C.—J. M. Bandy and W. H. Terrell, of Greensboro, are engineers in charge of the development of water power on So. Yadkin River for the Southern Yadkin Development Co.; the work contemplated will cost about $1,000,000.

Spencer, N. C.—The citizens are reported to have voted July 5 to issue $75,000 bonds to be used for water works, sewerage, electric lights, street improvements and graded schools.

Bellefontaine, O.—C. W. Buchanan, Supt. City Electric Light Plant, writes that bids will be received by the Bd. of Public Service, Aug. 10, for constructing a new electric light plant; probable cost, $50,000.

Toledo, O.—The Council has authorized F. I. Consaul, Ch. Engr. Bd. of Pub. Service, to prepare an estimate of probable cost of constructing a municipal electric light plant.

**Youngstown, O.*—The Electric Supply & Constr. Co., of Youngstown, is stated to have secured the contract for installing an electric light system at the new filter plant for $4,133.

Elyria, O.—Bids will be received until July 31 by the Bd. Pub. Service for furnishing and erecting the following machinery: A 125-hp. Scotch boiler, a low-service pump of 5,000,000-gal. capacity; bids to be received on both compound duplex and centrifugal pumps with a direct-connected compound vertical engine, as advertised in The Engineering Record.

Cincinnati, O.—Bids will be received until Aug. 11 by the Bd. Trus. Comrs. of Water Wks. (Aug. Herrmann, pres.) for laying c. i. pipe, special castings and valves, on Ludlow, Dodsworth and Hamilton Aves.

Ft. Stevens, Ore.—Bids will be received until July 20 by Capt. Goodale, Q. M., Astoria, for electric light fixtures and installing interior and exterior lighting systems at Ft. Stevens.

Greencastle, Pa.—The Boro. Council has passed the ordinance granting Isaac I. Wingert, of Chambersburg. representing the Greencastle Light, Heat, Fuel & Power Co., a franchise to establish, operate and maintain in Greencastle an electric light and gas plant.

Wampum, Pa.—An election will be held in Aug. to vote on issuing $12,000 bonds to be used to build a gravity water system, and to equip the borough with electric light, power to be procured from the Ellwood Power Co., of Ellwood, 5 miles distant. G. B. Zahniser, Clendennin Blk., New Castle, is engineer for the water works.

**Lansdale, Pa.*—Contracts for rebuilding the electric light plant are reported to have been awarded on July 5 as follows: To the Erie City Iron Wks., Erie, for the steam equipment, including 1 boiler and 2 engines and all connections; and the Ft. Wayne Electric Co., Ft. Wayne, Ind., for 2 dynamos of 125-kw. capacity and switchboard with all equipment and 60 enclosed arc lamps.

Scranton, Pa.—Bids will be received until July 21 by C. J. Gillespie, secy. Scranton Poor Dist., 624 Connell Bldg., Scranton, for furnishing and installing electric light fixtures required for the almshouse now being erected at Hillside Home near Clarks Summit, Pa. Edw. H. Davis, archt., Connell Bldg.

Greenville, S. C.—The Council has granted a franchise to the Saluda River Power Co., to string wires and supply electricity in this city for a period of 40 years.

Chattanooga, Tenn.—Local press reports state that plans are about completed for the proposed dam and power plant for the Chattanooga-Tennessee River Power Co., to be constructed under the supervision of Maj. Henry C. Newcomer, and work will begin about Sept. 1.

**Knoxville, Tenn.*—I. L. Faucett, Chamberlain Bldg., Chattanooga, has secured the contract for furnishing and installing at the East Tennessee Hospital for Insane, a 1,000-light dynamo directly connected to a 100-hp. engine and B. B. Dallas, of Knoxville, has secured the contract for two 100-hp. boilers.

Jas. B. Cahoon, Consulting Engr., 42 Bway., New York, N. Y., writes with regard to the proposed power plant of the Knoxville Power Co. on Tennessee River, that it will probably not be financed before fall and nothing will be done until then.

Bolivar, Tenn.—Bids will probably be received early in August for the construction of water works and an electric light plant, for which bonds to the amount of $20,000 have been sold. Engineer, Granberry Jackson, Nashville.

Clarksville, Tenn.—The Consumers Electric Light, Power, Htg. & Refrigerating Co. is reported formed here to construct an electric light plant.

Llano, Tex.—Engineer John W. Maxcy, of Houston, is reported to be investigating the feasibility of constructing a power plant on Llano River; also the construction of an irrigation system.

Port Townsend, Wash.—John Seiderbaum is reported to have petitioned Council for a franchise for a gas, electric light and heating plant.

Greenwood, Wis.—Bids will be received by Elias Peterson, City Clk., on July 25, for the construction of an electric light plant, consisting of dynamo, wiring, pole line and auxiliaries, also frame power house, concrete power dam, turbine water wheel, etc. Engineer, Oscar Claussen, Nat'l German American Bank Bldg., St. Paul, Minn.

**Ft. Mackenzie, Wyo.*—Capt. Jas. S. Parker, Q. M., U. S. A., Sheridan, writes that the contract for constructing an electric lighting system at Ft. Mackenzie (bids opened June 19) has been awarded to Berggren Electric Co., of St. Paul, Minn., for $10,801.

Napanee, Ont.—The citizens are reported to have voted July 7 to issue $35,000 bonds for a municipal electric light plant.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The Mineral Belt Traction Co., of Pyatt, Ark., and Chicago, Ill., is stated to have been granted a charter to build a line between Pyatt, Dodd City, Kingdon Springs and Lead Hill. Capital, $200,000. Incorporators: A. J. Bradford, Robt. Somerville, E. W. Swarz and Neal Dodd.

Willimantic, Conn.—The House of Representatives is stated to have passed in concurrence a resolution incorporating the Willimantic & Stafford Springs St. Ry. Co., to construct and operate a trolley line in the towns of Windham, Mansfield, Willington and Stafford. Incorporators: Costello Lippitt, Edwin W. Higgins, of Norwich, and Chas. W. Comstock, of Montville. Capital, $700,000.

Denver, Colo.—The construction of a $75,000 electric street car system is reported in contemplation for Tucson, Ariz., by W. S. Iliff and C. K. Durkin, of the United States Light & Traction Co., of Denver.

Indianapolis, Ind.—The Ohio Valley Traction Co. has amended its articles of incorporation and increased its capital from $50,000 to $250,000. According to the amended articles, the company will build a traction line from Indianapolis through Marion, Johnson, Warren, Brown, Monroe, Lawrence, Jackson, Washington, Floyd, Orange, Crawford, Perry, Dubois, Warrick and Vanderburg Counties to Evansville, and connecting the intervening cities and towns. Jos. H. Larimer, A. E. Faunce and D. H. Morgan, office, 406 State Life Bldg.

Huntington, Ind.—A franchise through Huntington County, north to the Whitley County line, is reported to have been granted to the Huntington, Columbia City & Northwestern Traction Co., by the Board of Commissioners. The company proposes to build north to Goshen and south to Indianapolis. All other desired franchises, county or city, have been granted.

Portland, Ind.—The Muncie & Portland Traction Co. is stated to have filed articles of incorporation, capital $100,000. The company proposes to construct, maintain and operate lines and systems of street and interurban railroads in, through and between Muncie, Albany, Redkey, Dunkirk and Portland, and thence into the State of Ohio. The principal office will be in Portland. A. E. Smith, Louis A. Clark, W. S. Richey and J. L. McPherson are the incorporators.

Shelbyville, Ind.—The Indianapolis & Southeastern Traction Co. is reported incorporated, with a capital of $1,200,000, for constructing and operating a traction line between Shelbyville and Greensburg, and thence to Batesville, and also to construct and operate plants for generating and supplying electricity for supplying heat, light and power to the inhabitants of the above-named towns and cities. Fletcher M. Durbin, W. J. Alford, C. C. Curtis and J. H. Smith are the incorporators.

Anderson, Ind.—It is stated that the Muncie & Portland Traction Co. (Wm. N. Wood, Ch. Engr., Muncie) will, next week, let contracts for the construction of a line from Muncie to Portland. H. C. Sillwell and George F. McCulloch, representing the new company. The bridge contracts have already been let. The new line will be 30 miles long and will eventually be extended to Celina, O.

Sulphur, Ind. Ter.—The Oklahoma, Lexington & Gulf Electric Ry. Co. is stated to have in contemplation the construction of an electric line from Oklahoma City to Sulphur, I. T., a distance of 80 miles.

South McAlester, Ind. Ter.—The Choctaw Railway & Lighting Co. is reported to have purchased purchased the rights of the Indian Territory Traction Co., and contemplates making extensive improvements. Incorporators are M. M. Lindly, A. E. Pierce, Jr., of South McAlester and W. R. Naughton, of Chicago.

Westminster, Md.—A project is stated to have been worked up for the construction of a trolley line from this city to a point between Winfield and Taylorsville, in the southern section of the county, to connect with a line from Gettysburg, Pa., to Washington, D. C. Jas. W. Le Gore, of Legore, is at the head of these projects, and has been for several years perfecting a plan for a far-reaching system of trolley lines and manufacturing industries, the means for producing the power necessary to operate the system being the construction of a dam across the Monocacy River, where its breaks through Rocky Ridge. At the point mentioned the Monocacy passes through a narrow gorge, where a dam 50 ft. high can be constructed at comparatively little expense. The route proposed for the main line of the projected trolley system passes from Gettysburg to Smithsburg, Rocky Ridge and into this county not far from Taylorsville on to Washington through Woodbine and Howard County.

Milford, Mass.—The Webb Pink Granite Co., of Milford, is stated to have decided to build a trolley line to connect its quarries with the tracks of the New York, New Haven & Hartford R. R.

Boston, Mass.—It is stated that the Nahant & Lynn Street Ry. (Wm. La Croix, Pres.) contemplates constructing a road which is to connect Lynn with the beach resorts.

Kansas City, Mo.—The proposed electric line between Kansas City, Leavenworth, Atchison and St. Joseph, in which Denison, Prior & Co., of Cleveland, O., have been and are interested, is to be built by the Missouri Valley Electric Ry., just incorporated; capital, $650,000. Incorporators: Geo. P. Blanchard, of New York; Charles P. Breen, Geo. B. Tuggle, and H. B. McAfee, of Parkville, Mo. The road is to be standard gage, 65 miles in length. The road is to be a high-class electric line, traveling the counties of Jackson, Clay, Platte and Buchanan, Atchison and St. Joseph, with a branch to Platte City. It will cross the Missouri River at Kansas City and at Leavenworth, at the latter place to acquire the property of the Leavenworth Ry. & Terminal Co. The company will install electric power to run trains in a multiple unit.

Long Island City, L. I., N. Y.—The trolley combination formed by August Belmont, Pres. of the Interborough Rapid Transit Co., and Ralph Peters, Pres. of the Long Island R. R. Co., has secured its first franchise for a trolley line in Nassau County. The combination purchased the New York & Long Island Traction Co., and immediately after the transfer of the property made an effort to secure a right of way along the Jericho Turnpike, one of the most important highways in the county. The company will build a line from Mineola to the New York City boundary line, near Queens, a distance of 6 miles.

Catskill, N. Y.—The Upper Hudson Electric R. R. Co., of Newburg, is reported incorporated to operate an electric railway 25 miles long from the terminus of the United Traction Co., of Albany, in the town of Bethlehem, to the village of Catskill. Capital, $500,000. Directors: Luke F. Gillespie, of Newburg; Eugene Wolfe, of Athens; T. M. Sheeman, Coxsackie; H. W. Dalton, Thompsonville, Conn. This company is practically a reorganization of the former Upper Hudson Electric Co., which had a capital stock of $150,000. The new company probably will succeed to the franchises secured several years ago to build an electric railway down the west bank of the Hudson, from Kenwood to Catskill.

Albany, N. Y.—The Ticonderoga Union Terminal R. R. Co. is reported incorporated to operate a street railway from the bridge of the Rutland Railroad at Addison Junction to Ticonderoga Village. The length is 5 miles. It is planned to cross the Delaware & Hudson R. R. tracks a short distance north of the highway at Addison. Capital, $50,000. Directors: I. Rothschild, Altus B. Adkins, of Ticonderoga, and Frank B. Gridley and Northrup R. Holmes, of Troy.

Auburn, N. Y.—The Auburn & Ithaca Traction Co. is reported incorporated with a capital of $400,000. The company is to build a standard gage electric railroad from Auburn to Ithaca. From the city limits of Auburn the road will run southerly along the highway about 25 miles, along the east short of Cayuga Lake to the northerly limits of the city of Ithaca, and upon Cayuga St. and Spencer St. to the southerly limits of the city. Directors are Sherman Collins, of Ithaca; Edwin B. Mosher, of Poplar Ridge; Jas. G. Cozens, of Chicago, Ill., and John H. Grant, of Utica.

Dansville, N. Y.—It is stated that the Rochester & Southern R. R. Co. contemplates constructing an electric railway from Elmira to Rochester, a distance of 120 miles.

Lima, N. Y.—Wm. J. Conners, of Buffalo, is stated to have purchased rights of the Lima-Honeoye Electric Light & R. R. Co. It is understood that the road will now be extended.

Lima, O.—J. A. Bendure, Gen. Mgr. of the new Toledo & Lima Traction Co., is reported to be receiving bids for the construction of the first 6 miles of the road from Lima to Cairo. There is one large cut and a long fill in this section.

Oberlin, O.—The Oberlin & Lorain Ry. Co. is reported organized with M. D. Skeels, Pres., and C. R. Summers, Secy. The company has secured practically all right of way between Oberlin and Lorain and is applying for franchises in the streets of these places.

Steubenville, O.—The Steubenville & Wheeling Traction Co. is stated to have increased its capital stock from $400,000 to $650,000, to be used in changing the route of its line from Steubenville to Mingo Junction, so as to avoid heavy grades, and possibly for the extension of the line south from Brilliant.

Cleveland, O.—The Pomeroy Syndicate is reported to have announced that the building of the Cleveland, Ashland & Mansfield Railway is now assured. The line will start near Chippewa Lake and connect Ashland and Mansfield with Cleveland.

The Suburban Improvement Co., composed of Sig. Lederer, J. A. Stuber and A. A. Lederer, of Cleveland, are reported to be endeavoring to secure a right of way from Cleveland to South Lorain, by way of French Creek and Dover Center.

Barberton, O.—The Barberton, Wadsworth & Western Traction Co., which proposes to build from Barberton to Wadsworth, is reported to have filed a bid for a franchise over the route it desires for entrance to Barberton.

Cincinnati, O.—It is stated that the Cincinnati, Milford & Loveland Traction Co. contemplates extending the line to Blanchester. B. H. Kroger, Pres.

Steubenville, O.—It is stated that the Canton & Steubenville Traction Co. contemplates constructing an electric railway. T. H. Loomis is reported interested.

Dayton, O.—The Dayton & Irvington St. Ry. Co. is reported incorporated by M. P. Nisewonger, J. W. Bovey, F. M. Stutsman, C. J. Geyer and others. The company will build a short suburban road out of Dayton, extending along the Still water to Irvington Place and into Mt. Auburn.

Oberlin, O.—The Oberlin & Lorain Ry. Co. contemplates constructing an electric railway between Oberlin and Lorain, running by way of North and South Amherst. Most of the right of way has been secured, and it expects to start grading in a short time. Directors: M. D. Skeels, W. F. Stanley and others.

Clifton Heights, Pa.—The Borough Council is stated to have granted, on July 7, the Philadelphia & Garrettford St. Ry. Co. the right to construct and operate a trolley line in the borough.

Shamokin, Pa.—Plans are stated to have been formulated here for the immediate construction of the $1,500,000 trolley line between Shamokin and Sunbury. Ex-Congressman M. H. Kulp is reported interested.

Chattanooga, Tenn.—The Chattanooga Electric Ry. Co. is reported to have decided to build a line to Lookout Mountain and another to Chickamauga Park within the very near future.

Austin, Tex.—Articles of incorporation of the Gainesville, Whitesboro & Sherman Electric Ry. are reported to have been filed in the State Department. Its purpose is to build an interurban line between Gainesville and Sherman, a distance of 32 miles. Capital, $500,000.

Rossland, B. C.—The Canadian Pacific Ry. Co. (W. F. Tye, Ch. Engr., Montreal, Que.) is reported to be considering the utilization of electric power for the operation of its road between Rossland and Thail.

**Items marked thus give the names of parties awarded contracts.*

Kingston, Ont.—Dr. Ball, of Detroit, Mich., is reported to have made a proposition to the city to acquire the street railway and to build a new system.

Brantford, Ont.—The City Council has given its final assent to the Hamilton, Ancaster & Brantford Co. to come into Brantford over the existing tracks of the Brantford St. Ry. Co., along Colborne St.

RAILROADS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The Santa Fe R. R. Co. (W. B. Storey, Ch. Engr., Topeka, Kan.) is reported to have decided to establish freight yards on the China Basin property and erect two freight houses, to cost in all about $10,000,000.

Jacksonville, Fla.—The Jacksonville, Fernandina & Southern Ry. Co. has been incorporated, to build and operate a railroad between Jacksonville and Fernandina, a distance of about 28 miles. Incorporators: Saml. A. Swann, Fernandina; John R. Young, Savannah, Ga.; Eugene E. West, of Jacksonville, and others.

Ft. Wayne, Ind.—The Ft. Wayne, Indianapolis & Southwestern Steam Ry. Co. is reported to be preparing to present petitions to the Grant County Comrs., to set dates for elections to be held in Van Buren, Center and Green Townships and possibly Liberty Township, to vote subsidies to the road. As now planned the road will pass through Indianapolis, Malott Park, Noblesville, Elwood, Perkinsville, Lapel, Pt. Isabel, possibly Weaver and Hackleman, Marion, Van Buren, Warren, Markle, Zanesville and Ft. Wayne.

Iowa Falls, Ia.—W. T. Sowder, Supt. Iowa Falls & Northern R. R. Co., writes that about 45 miles of line will be constructed. Engineer, T. R. Hasley.

Madisonville, Ky.—The Madisonville, Hartford & Eastern R. R. Co. has been incorporated by H. H. Holeman, Geo. R. Lynn and W. P. Ross, of Madisonville; J. W. Ford and R. E. Lee Simmerman, Hartford, to construct a standard-gauge railroad from Madisonville through Hopkins, Muhlenberg, McLean and Ohio Counties via Hartford to Mitchell's Station, on the Irvington branch of the Louisville, Henderson & St. Louis R. R.

Hyde Park, Mass.—The State R. R. Comrs. have agreed to adopt plans proposed by the town for abolishing the grade crossing at Fairmount Station.

Jersey City, N. J.—The Street and Water Board on July 10 passed over the veto of the Mayor the resolution authorizing the Erie R. R. Co (Francis Lee Stuart, Ch. Engr., New York, N. Y.) to construct an open cut for 4 tracks across the Heights.

Highland Falls, N. Y.—The State R. R. Comn. is reported to have granted the application of the Erie & Jersey R. R. Co. to issue bonds for $10,000,000 for a new line 43 miles long, from Highland Falls to Guymard, connecting with the Erie R. R. (Francis Lee Stewart, Ch. Engr., New York, N. Y.).

Lorain, O.—The Lorain & Ashland R. R. Co. is reported incorporated, with a capital of $5,000, to construct line between Lorain and Ashland. Principal office to be at Ashland. Incorporators: J. W. Patterson, N. P. Ramsey, W. E. Griffiths, and others.

**Stewartstown, Pa.*—The directors of the New Park & Fawn Grove R. R. Co. are reported to have awarded to John H. Dobbling, of Philadelphia, the contract to grade and lay the tracks for the new steam railroad. About $50,000 has been subscribed toward the project. The road will be operated by the Stewartstown R. R. Co. It extends 9 miles from Stewartstown to Fawn Grove.

Chattanooga, Tenn.—The projected Ohio, Knoxville & Port Royal line and the Tidewater Ry. are reported to have been consolidated unde rthe title of the Chattanooga, Anderson & Atlantic R. R. Co.; capital $300,000. Headquarters of the company will be at Anderson, S. C. The new line will be run from Chattanooga via Ducktown, Tenn., Spartanburg, S. C., Union, Anderson and through North Carolina making connection with the Tidewater in Virginia. The Knoxville branch will probable run east through East Tennessee. Directors: Albert A. Martin, Chicago, Ill.; J. E. Breazale and J. J. Fretwell, of Anderson, S. C., and R. E. A. Mambly, of Clayton, Ga.

Knoxville, Tenn.—The Tennessee Central R. R. Co. (L. F. Lonnbladh, Ch. Engr., Nashville) is reported to have under consideration the construction of about 300 miles of extensions, including branches to Knoxville and Paducah, Ky.

**Trinity, Tex.*—Contracts have been let for the immediate construction of 20 miles of the Beaumont & Great Northern Ry., from Trinity to Onalaska. This line was recently chartered from Trinity to Livingston, 37 miles. Surveys have been completed. A branch line from Groveton to Onalaska is proposed for construction in the near future. Wm. Carlisle, president, and L. T. Sloan, Ch. Engr., both of Trinity.

Mexia, Tex.—The Houston & Texas Central R. R. Co. has surveyed and will amend its charter providing for the construction of a cut-off from Mexia south to Navasota, about 100 miles. G. F. Hawks, Mgr., and I. A. Cottingham, Ch. Engr., both of Houston.

Spokane, Wash.—The Spokane & Columbia River Ry. & Navigation Co. is reported to be preparing to build southwest, from Spokane, througgh the counties of Spokane, Whitman, Adams and Franklin to Columbia River, there connecting with the Portage road to Portland.

St. John, N. B.—Bids will be received until July 25 by Geo. G. King, Chmn. Comrs. of the New Brunswick Coal & Railway, P. O. Box "B," St. John, for rebuilding certain bridges and trestles and making other improvements to the permanent way of the railway from Norton to Chipman.

Victoria, B. C.—The Canadian Pacific Ry. Co. (W. F. Tye, Ch. Engr., Montreal, Que.), which recently purchased the Esquimalt & Nanaiamo Ry., between Victoria and Wellington, is reported to have decided to place survey parties at once in the field looking to the extension of the line to the north end of Vancouver Island.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—The Capitol Comn., it is stated, has accepted the plans of Frank Dockwood, of Montgomery, for enlarging and remodeling the capitol at a cost of $70,000.

Columbiana, Ala.—The Co. Comrs., it is stated, are contemplating the erection of a court house at a cost of $59,000.

**Wynne, Ark.*—E. L. Koonce, of Warren, Ark., it is stated, has received the contract to erect the court house at about $61,000.

Newport, Ark.—Bids are wanted July 29 for the erection of a jail at Newport, as advertised in The Engineering Record.

Washington, D. C.—Bids will be received until July 20 by Col. F. L. Denny, Q. M., U. S. M. C., for constructing an addition to the Marine Barracks, including band room, mess hall, gymnasium, completion of guard room, prison and amusement room, Washington, D. C.; a deposit of $20 required on plans and specifications.

Bids will be received until Aug. 1 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for constructing at the new Naval Hospital, Washington, D. C., a power house about 88 ft. 6 in. long by 36 ft. wide, and with 16 ft. clear head room, and a perforated radial molded brick chimney 75 ft. high above the foundations, and having an internal diameter of not less than 3 ft. 8 in.; H. T. B. Harris, Paymaster-Gen., U. S. N.

Washington D. C.—Bids will be received by Elliott Woods ,Supt. U. S. Capitol Bldg. and Grounds on July 29 for cut stone work for exterior facades and court walls of office building, U. S. Senate, as advertised in The Engineering Record.

**Washington, D. C.*—Jas. L. Parson, of Washington, is reported to have secured the contract for constructing the superstructure of the municipal building (bids opened July 1) for $995,000.

*J. E. Reynolds, of Washington, D. C., it is stated, has secured the contract to erect a gymnasium at Ft. Washington, at a cost of about $15,000.

Atlanta, Ga.—Bids will be received until July 25 by the Bd. Fire Masters for erecting a 2-story brick fire station. Morgan & Dillon, archts., 704 Prudential Bldg.

Boise, Idaho.—The plans of J. E. Tourtelotte & Co., of Boise, it is stated, have practically been accepted by the Capitol Bldg. Comn., for the new capitol, the estimated cost being $350,000.

Chicago, Ill.—Bids will be received until July 18 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for furnishing material and erecting a 2-story and basement fire engine house at Our St. and Short Pl., Jefferson Park. Bids on the following work to be submitted separately: Mason and concrete work; cut stone work; iron work; sheet metal work, steel ceiling and gravel roofing; plumbing, sewerage, gasfitting and electric wiring.

**Kokomo, Ind.*—Jesse Lindley, it is stated, has secured the contract for the heating plant in the court house and jail at $3,135.

Muncie, Ind.—It is reported that the Co. Comrs. have authorized plans to be prepared for a county hospital which it is proposed erecting at a cost of $25,000.

**Valparaiso, Ind.*—The Co. Comrs., it is reported, have awarded the contract to erect the county infirmary to C. E. Foster at $25,000.

National Military Home, Ind.—It is reported that bids will be received until July 25 for constructing a refrigerating and cold storage plant and conservatory. Address John Q. Adams, treas.

Burlington, Ia.—Bids will be received until Aug. 17 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction complete of the extension of the U. S. Post-Office at Burlington.

Frankfort, Ky.—Bids are wanted Aug. 1 for the construction of the State Capitol Bldg. at Frankfort, as advertised in The Engineering Record.

Latonia, Ky.—Bids will be recevied until Aug. 7 by G. W. Jameson, Farmers & Traders Bank Bldg., Covington, for furnishing material and erecting a brick and stone County Infirmary at Latonia. Architects, Brown & Dawes, Cincinnati, O.

Lexington, Ky.—Bids will be received until July 26 for erecting the Good Samaritan Hospital on S. Limestone St., near Pine, bids to include plumbing, heating, electric wiring, etc. Address J. P. Shaw, 2d Natl. Bank Bldg.

Gretna, La.—The plans of W. S. Hull, of Jackson, Miss., it is stated, have been accepted for the court house which is to be erected here at a cost of $60,000.

Baltimore, Md.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., Aug. 14, for interior finish, etc., for U. S. Custom House at Baltimore, as advertised in The Engineering Record.

Ft. Revere, Hull, Mass.—Bids will be received until July 21 by Maj. John E. Baxter, Quartermaster, U. S. A., Boston, for furnishing material and constructing and electric wiring a brick quartermaster and commissionary storehouse and a 7-section frame wagon shed and sections closed, at Ft. Revere, Hull.

Muskegon, Mich.—The Co. Comrs. are reported to have decided to rebuild the infirmary, at a cost of $50,000.

Jefferson City, Mo.—Bids will be received by the Bd. of Comrs. (W. C. Marshall, Chmn.) on July 31 for construction of new Supreme Court Building, as advertised in The Engineering Record.

Kansas City, Mo.—The Council has appropriated $36,000 for the erection of 2 fire stations.

Higginsville, Mo.—It is reported that bids will be received until Aug. 1 for erecting a hospital building for the Confederate Home. Separate bids to be submitted for heating and plumbing. N. F. Belle, archt., Fulton, Mo.; W. S. McClintic, secy.

Newark, N. J.—Bids will be received until July 26 by Com. on Pub. Bldg. of the Common Council (Wm. Pennington, Chmn.) for furnishing material and erecting the 3d Ward fire engine house at 15 Prince St. and the Waverly section fire engine house at Frelinghuysen Ave. and Fenwick St., work to consist of masonry, carpentry, iron work, electric work, plumbing, heating, etc.

Trenton, N. J.—Bids will be received until July 20 by the Bd. Mgrs. of the New Jersey State Hospital at Trenton (Garret D. W. Vroom, pres.), for furnishing material and erecting additions to the Annex to the State Hospital. Cost reported to be about $250,000.

The Pauly Jail Bldg. Co., St. Louis, Mo., it is stated, has received the contract to erect a new wing at the State Prison, bids for which were opened on July 11, at $226,385. Other bids received were as follows: Jos. Cutley, Jersey City, $219,460; Jas. W. Lanning, Trenton, $235,000; Thos. H. Prior & Sons, Trenton, $245,550; Lewis Lawton, Trenton, $232,674; William Johnson, Trenton, $238,848; Wm. Van Doran, Cleveland, $234,877.

Jersey City, N. J.—Governor Stokes, it is stated, has signed the bill authorizing the issuing of bonds in Hudson County for the erection of a new almshouse, the cost not to exceed $200,000.

**New York, N. Y.*—Foster & Aldorf, 181 Bway, has secured the contract for completing two isolation ward buildings at Riverside Hospital, on North Brother's Island (bids opened July 5) for $31,723.

New York, N. Y.—Bids will be received until July 18 by the Dept. of Health (Thos. Darlington, pres.) for furnishing material and making alterations to the Willard Parker Hospital, foot of E. 16th St.

Bids will be received until July 25 by Nicholas J. Hayes, Fire Comr., for repairs to quarters of Engine Co. No. 38, and for furnishing material and erecting a building for Engine Co. No. 23, both in Manhattan Boro.

Rochester, N. Y.—It is stated that a 2-story brick building is to be erected at the City Hospital, at a cost of $50,000.

Ft. Wood, N. Y. H., N. Y.—Capt. Traber Norman, Q. M., U. S. A., Governors Island, writes that all bids opened on June 20 for erecting a hospital at Ft. Wood, have been rejected and new bids will be called for.

Buffalo, N. Y.—Bids will be received until Aug. 17 by Col. H. M. Adams, U. S. A. Engr., for building a concrete superstructure at the Inner Beacon of MaumeeBay, Straight Channel Ranges, Ohio.

Rome, N. Y.—Bids will be received by Jas. A. Douglass, Pres. Bd. Mgrs. Rome State Custodial Asylum, on Aug. 7 for construction, heating, etc., ward bldg. J, as advertised in The Engineering Record.

**Oneonta, N. Y.*—The Champion Iron Co., of Kenton, O., it is reported, has secured the contract to repair the Otsego County jail at $15,000.

Rochester, N. Y.—Bids will be received until July 26 by the Bd. Contract & Supply (F. X. Pifer, Clk.) for erecting a Fire Dept. headquarters building on Central Ave.

**Niagara Falls, N. Y.*—Richardson & Burgess, Washington, D. C., have secured the contract for constructing complete the U. S. Post-Office at Niagara Falls, for $104,680.

Portland, N. D.—Bids will be received until July 21 by E. K. Erickson, Recorder, for erecting a brick and stone fire engine house and cistern.

Cleveland, O.—J. Milton Dyer, Cuyahoga Bldg., it is stated, is preparing plans for the tuberculosis hospital which the Bd. Pub. Service proposes erecting at Warrensville.

Carthage, O.—Bids will be received until Aug. 5 by the Bd. Directors of Hamilton County Infirmary at Carthage, for furnishing material and remodeling the infirmary, work to include cement work and mosaic tiling, carpenter work, steel stack and breeching, plumbing, roofing and sheet metal work, etc. Eugene L. Lewis, Co. Aud.

Oberlin, O.—It is stated that plans have been approved for the Carnegie Library, which is to be erected at the northwest of the campus at a cost of $225,000.

Portland, Ore.—Bids will be received until Aug. 3 by Maj. W. C. Langfitt, Corps. Engrs., U. S. A., Portland, for constructing quarters, buildings, etc., at Cascade Locks, Ore.

Cascade Lakes, Ore.—Bids will be received until Aug. 3 by Maj. W. C. Langfitt, Corps Engrs., U. S. A., Portland, Ore., for constructing quarters, buildings, etc., here.

Panama.—Bids will be received until Aug. 7 by the Isthmian Canal Comn. (D. W. Ross, Gen. Purchasing Officer), Washington, D. C., for furnishing doors and sash.

**Lebanon, Pa.*—Fissell & Wagner, of New York, N. Y., have secured the contract for constructing the U. S. Post-Office at Lebanon, for $46,511.

Wernersville, Pa.—Bids will be received until July 22 by J. M. Shenk, Chmn. Bldg. Com., for furnishing material and erecting an attendants' dormitory at the State Asylum for the Chronic Insane at South Mountain, Wernersville. A. A. Ritcher, archt., Lebanon, Pa.

Erie, Pa.—The Bd. of Fire Comrs., it is stated, has approved plans for an engine house to be erected on East Ave.

McKeesport, Pa.—Bids will be received until Aug. 16 by James Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing complete the U. S. Post-Office at McKeesport.

Deadwood, S. D.—The following are the 3 lowest bids opened July 12 by the Superv. Archt., Treas. Dept., Washington, D. C., for the low pressure steam heating apparatus complete for U. S. Post-Office at Deadwood: Iowa Mfg. Co., Oskaloosa, Ia., $4,187; F. M. McGuire, Minneapolis, Minn., $4,769, and Allen-Black Co., St. Paul, Minn., $4,831.

Hot Springs, S. D.—Bids will be received until Aug. 5 at the office of Thos. R. Kimball, archt., 503 McCague Bldg., Omaha, Neb., for furnishing material and erecting a superintendent's house, power house, stable, spring house and reservoir at the Battle Mountain Sanitarium, National Home for D. V. S. at Hot Springs.

Livingston, Tex.—Bids are wanted July 20 for erecting a 2-story fireproof office and record building, 24x44 ft. Address Country Judge. L. H. Green, archt., Rm. 233, Commercial Bank Bldg., Houston.

Memphis, Tenn.—Plans are being prepared, according to reports, by Jones & Furbringer, for a $30,000 hospital which is to be erected by Dr. F. D. Smythe and Dr. D. G. Henning, and is to be known as the Smythe & Henning Surgical & Gynecological Infirmary.

Items marked thus give the names of parties awarded contracts.

**Ft. Myer, Va.*—Jos. S. Reynolds, of Washington, D. C., it is stated, has secured the contract to erect officers' quarters here at a cost of about $40,000.

Salem, Va.—Bids will be received until Aug. 10 by the Co. Superv. (B. W. Logan, Chmn. Jail Com.) for enlarging and remodeling the Roanoke County Jail at Salem.

**Lynchburg, Va.*—The contract for building the George M. Jones Memorial Library in Rivermont is reported to have been awarded to W. B. Snead & Co., 1321 Main St., for $34,000.

Ft. Casey, Wash.—Bids will be received until July 27 by Geo. H. Penrose, Q. M., U. S. A., Port Townsend, for constructing an additional story to the Ft. Casey Hospital.

Ft. Wright, Wash.—The following are the bids opened on July 6 by Capt. E. A. Shuttleworth, Q. M., U. S. A., for construction, etc., of two double barrack buildings at this post: (*a*) Construction, (*b*) plumbing, (*c*) heating, (*d*) wiring: McInnis & Harrington, Ft. Casey, *a* $110,600, *b* $14,500, *c* $11,300, *d* $1,900; McInnis & Reed, Portland, Ore., *a* $110,768, *b* $13,576, *c* $10,998, *d* $2,548; Pacific Electric Co. Portland Ore., *d* $1,852; McBride Electric Co., St. Paul, Minn., *d* $2,543; G. A. Kees Eng. Co., St. Paul, Minn., *b* $13,900, *c* $9,994; Healy Plumbing & Htg. Co., St. Paul, Minn., *b* $14,450, *c* $10,080; Bringham & Hoska, Seattle, *a* $104,570, *b* $14,000, *c* $11,500, *d* $1,800; J. H. Randall, Seattle, *a* $125,900; Burrell Contr. Co., Portland, Ore., *a* $113,740; Wm. E. Chase Eng. Co., Spokane, *d* $1,998; Arnold-Evans Co., Spokane, *b* $15,764, *c* $10,362; Hastie & Dougan, Spokane, *a* $112,900, *b* $13,844, *c* $10,858, *d* $1,900; Theo. M. Barr, Salem, Ore., *c* $10,500; R. Dalziel, Jr., Co., Oakland, Cal., *b* $14897, *c* $10,500; Bowland Weston, Spokane, Wash., *b* $13,500, *c* $9,500; R. C.McCaffrey, Spokane, *b* $14,500; Warren Oliver, Spokane, *d* $1,616; Berggren Elec. Co., St. Paul, Minn., *d* $1,900.

Sheboygan, Wis.—It is proposed to erect a new fire station this season, at a cost of $15,000.

Wauwatosa, Wis.—Wolff & Ewens, of Milwaukee, it is stated, are preparing plans for remodeling the county hospital here, the cost to be about $20,000.

Calgary, Alta.—Bids will be received until Aug. 7 by the Dept. of Pub. Wks. (Fred. Gelinas, secy.) at Ottawa, Ont., for erecting additions, etc., to the Post-Office at Calgary.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Decatur, Ala.*—Blair & Co., of Montgomery, are stated to have received the contract for erecting a passenger station here, for about $50,000.

Little Rock, Ark.—The Hotel Marion Co., it is stated, has been incorporated with a capital of $250,000, and intends erecting a modern hotel in Little Rock. Herman Kahn, Pres.

**Los Angeles, Cal.*—The contract for erecting a Masonic Temple in Los Angeles is reported to have been awarded to P. A. Mulford, for $58,000.

Dr. Thaddeus Updegraf, of Pasadena, it is stated, intends erecting a 6-story loft building on Main St., at a cost of $175,000 and has had plans prepared by Parkinson & Bergstrom.

San Francisco, Cal.—The Masonic Temple Assoc. is stated to have decided to erect a 4-story brick building at Shattuck Ave. and Bancroft Way, to cost $70,000. W. H. Wharff, Archt.

San Francisco, Cal.—See "Railroads."

Marysville, Cal.—It is reported that a 5-story hotel is to be erected by John I. Packard at an estimated cost of $500,000.

Denver, Colo.—Plans are stated to have been prepared for the Symes block, to be erected at Champa and 16th Sts. The structure to be 8 story and cost about $300,000. A. B. Hoffman, Archt.

Chicago, Ill.—The Chicago Portrait Co. is stated to have purchased a site 70x101 ft. at Wabash Ave. and Congress St., for the erection of a 16-story building, to cost $300,000.

A. E. Norman is reported to have prepared plans for a store and flat building, to be built at Devon Ave. and N. Clark St., for Sivert Hollesen. It will be 3 stories, 175x75 ft., and cost $60,000.

Henry Wittekind is reported to be the successful architect in a competition for plans for a club house for the Birchwood Country Club, to be built on Chase Ave., east of Sheridan Road, near the lake, in Rogers Park. The building will be a 2-story structure, 49x90 ft., with annex of 16x37 ft., and cost $25,000.

Wm. G. Barfield is reported to be preparing plans for a brick and stone building, 130x100 ft., to be built at 47th St. and Prairie Ave., for Elwin A. Roser. The building will contain 7 stores, 15 offices and a hall for public gatherings; estimated cost $30,000.

*Contracts for the construction of the addition to the building of Marshall Field & Co., at 73-85 Wabash Ave., is stated to have been awarded to D. H. Burnham & Co., the American Bridge Co. doing the structural steel and iron work. The addition will cover 158x151 ft. of ground and will have a front of granite in harmony with the new building in State St.; estimated cost $600,000.

It is stated that a 14-story building will be erected at 81 Madison St. for the Boston Store. Mollie Netcher is reported interested.

A 2-story warehouse for both inbound and outbound freight will be erected for the Pere Marquette R. R. Co. near its terminal station, at Harrison and Polk Sts. The building will be 800 ft. long and varying in width from 200 to 75 ft., and will have elevated driveways, as well as inclined tracks for railroad cars, by means of which inbound freight will be unloaded on the upper and outbound on the lower floor. The cost is estimated at $200,000.

Webster City, Ia.—It is stated that Col. M. L. McCollough will erect a stable here, at a cost of $20,000.

Estherville, Ia.—A. M. Jeffries, of Estherville, is reported to have prepared plans for a 2-story, 66x120-ft. brick building, for the North Star Lodge No. 446, A. F. & A. M. and associate bodies; estimated cost, $23,000.

Des Moines, Ia.—C. C. Cross & Son, Good Blk., are stated to have completed plans for a building to be erected on 6th Ave. and High St. for the J. K. & W. H. Gilcrest Lumber Co. The structure to be 90x128 ft. and cost about $30,000.

Proudfoot & Bird, Crocker Bldg., are stated to have completed plans for a 3-story brick business block, 66x90 ft., to be erected at 7th and Mulberry Sts., for M. Younker; probable cost, $20,000.

Louisville, Ky.—Henry Besten, of Besten & Langen, it is stated, intends erecting a store and apartment building at Baxter and Highland Aves., at a cost of $50,000.

J. J. Gaffney, 455 W. Jefferson St., it is stated, is preparing plans for a club house for the Young Men's Institute, which is to cost about $20,000.

Crowley, La.—It is stated that a hotel will be erected here at a cost of $40,000. Mrs. A. T. Roberts, Prop. Crowley House, is reported interested.

Crowley, La.—Plans have been accepted for a 3-story, 62x133-ft. hotel, which is to be erected by Mrs. A. F. Roberts, at Parkerson Ave. and First St., at a cost of $40,000.

Bangor, Me.—Plans are stated to have been completed for the 82x194-ft. brick passenger station, to be erected at City Point by the Maine Central R. R. (Theo. L. Dunn, Ch. Engr.).

Baltimore, Md.—It is reported that plans are being prepared by Stoughton & Stoughton and W. D. Hunter, 96 5th Ave., for a warehouse to be erected at 32 S. Calvert St., for the Larrabee estate.

A permit is stated to have been issued for a 6-story brick building, to be erected at Monument St. and Washington Pl., at a cost of $183,000, for W. T. Corcoran.

At a convention being held in this city by the Christian Endeavor Society, it is reported that it has been decided to erect a memorial building to the Rev. Dr. Francis E. Clark, which is to cost about $2,000,000. It has not as yet been decided in what city it will be erected.

Springfield, Mass.—Bids will be received until July 26 by the Bldg. Com. (J. W. Nickels, Chmn.) at 441 State St. for erecting a building on Pynchon St. for Hampden Lodge, I. O. O. F.

**Muskegon, Mich.*—Buck & Millen, of Muskegon, it is reported, have received the contract to erect a wholesale house for Geo. Hume & Co., at about $15,200.

Detroit, Mich.—The Country Club is stated to have decided to erect a club house here, at a cost of $60,000.

Thief River Falls, Minn.—Archt. Keck, of Crookston, is stated to have completed plans for the Meehan and Dobner bank and business block, to be erected at Thief River Falls, at a cost of $30,000.

**Jackson, Miss.*—The Jones Kennington Dry Goods Co. is stated to have awarded the contract for erecting the department store at Capitol and Congress Sts. to McGee & Garter. The structure to be 6-story, 80x102 ft., and cost about $60,000.

Minneapolis, Minn.—Mark Fitzpatrick, 17 W. 9th St., St. Paul, it is stated, has prepared plans for remodeling the Printers' Exchange Bldg., at 18 and 20 4th St., at a cost of about $40,000.

Minnneapolis, Minn.—Boehme & Cordella, Kasora Bldg., are stated to have prepared plans for a hotel to be erected at Post Office Court and 1st Ave., S., for the Minneapolis Brewing Co.; probable cost, $500,000.

Kansas City, Mo.—The Rock Island and the St. Louis & San Francisco Ry. Cos. are stated to have completed plans for the erection of a storage warehouse in Kansas City, to cost $1,000,000.

Kansas City, Mo.—J. G. Bracklein, 15 W. 9th St., is reported to be preparing plans for a 3-story hotel, to be erected at 9th St. and Proost Ave.; estimated cost, $50,000.

St. Joseph, Mo.—It is stated that Roberts, Parker Merchandise Co. contemplates erecting a 4-story building at a cost of $75,000.

Omaha, Neb.—Chas. Cleves, 1st National Bank Bldg., is reported to be preparing plans for a 6-story, 66x132-ft. warehouse, to be erected on Jones and 10th Sts., for J. A. Creighton, at a cost of $70,000.

It is reported that the members of the Masonic Lodge have decided to erect a $175,000 building at 20th and Douglas Sts. Address secy.

Newark, N. J.—Alfred Peter, 327 Washington St., it is stated, is preparing plans for a 3-story brick store and apartment building which is to cost about $25,000.

New York, N. Y.—Plans have been filed for a 1-story brick railroad station, which it to be erected at 184th and Exterior Sts., Univ. Heights, for the N. Y. Central & Hudson River R. R., at a cost of $40,000. Reed & Stem, 5 E. 42d St., Archts.

**New York, N. Y.*—The United Engineering Building Committee has awarded to Wells Bros. Co., 160 5th Ave., the contract for the general construction of its building on W. 39th St., for $795,000. This does not include steam heating plant, electric wiring, etc. The ground is already excavated and work will begin at once.

Plans have been filed for alterations to be made to the 5-story office and loft building at 452 Water St. and 187 Cherry St., owned by the Edw. F. Keating estate; cost, $35,000. Horgan & Slattery, archts., 1 Madison Ave.

Brooklyn, N. Y.—The plans of Herts & Tallant, 32 E. 28th St., N. Y. City, it is stated, have been accepted by the Bldg. Com. for the new Academy of Music, which is to be erected on Lafayette Ave., between St. Felix St. and Ashland Pl. It is to be fireproof, 4 stories high, of brick and terra cotta, and is to cost about $750,000.

Long Island City, L. I., N. Y.—It is stated that the Long Island R. R. Co. (J. R. Savage, Ch. Engr., Jamaica) contemplates expending $65,000 for 5 stations, to be erected at Lawrence, Locust Valley, Sayville, Cedar Hurst and Hewlett.

Castile, N. Y.—Dr. J. S. Dawson is reported to have purchased a site for the erection of a sanitarium, to cost $30,000.

Portsmouth, O.—It is stated that Frey & Chesterman, of Lynchburg, Va., have been selected to prepare plans for a Y. M. C. A. building, to be erected in Portsmouth, at a cost of $20,000.

Lehman Bros. are stated to have decided to erect a 3-story brick building on Chillicothe and 3d Sts.

Cleveland, O.—Herman Kelley, it is reported, intends erecting a warehouse on Huron St., at a cost of $20,000.

Cincinnati, O.—A building permit has been granted to J. W. Harberson to erect a $25,000 store and flat building at 6th and John Sts.

**Toledo, O.*—A. Bentley & Sons are stated to have received the contract for erecting a 6-story, 120x120-ft. building at Jefferson Ave. and Superior St., for the Commonwealth Bldg. Co.; probable cost, $150,000.

Portland, Ore.—The plans of E. E. Hendricks are stated to have been accepted for the national home of the Woodmen of Woodcraft, to be erected at 10th and Taylor Sts., the building to be 60x96 ft., 3 story and cost $40,000.

**Philadelphia, Pa.*—John R. Wiggins & Co.,, Heed Bldg., it is stated, have received the contract to repair the fire damages to the building at 1302 Filbert St. for the Horn & Hardart Baking Co., at a cost of about $23,800.

Pittsburg, Pa.—It is reported that H. C. Frick has had plans prepared for an office building which he proposes erecting opposite the Frick Bldg., at a cost of $10,000,000. It is also reported that he will erect a 20-story hotel on Grant St., at a cost of $10,000,000, which is to be known as The Frick.

**Tarentum, Pa.*—Frank McClure, of Chicago, Ill., is stated to have received the contract for erecting the opera house here (bids opened by Tarentum Realty Co. on June 28), for $26,070.

Pittsburg, Pa.—It is stated that H. C. Hodgens has been selected to prepare plans for adding 3 stories to the Hotel Lincoln at Penn Ave. and Evans Alley, at a cost of $75,000.

The Y. M. C. Assoc. is stated to have purchased a site at 57 Chatham St., for the erection of a 4-story building, at a cost of $300,000.

Memphis, Tenn.—It is stated that an 8-story, 31x100-ft. addition will be erected on Main St. to the Hotel Gayoso; probable cost, $60,000.

Nashville, Tenn.—The roundhouse of the Louisville & Nashville Ry. Co. is reported destroyed by fire.

Chattanooga, Tenn.—Bearden & Foreman are preparing plans for the First State Bank, which is to be 3 stories high, of brick and stone and is to be erected on Market St.

Livingston, Tex.—Bids are wanted until July 20 for erecting a 2-story brick business building, 60x120 ft. L. H. Green, archt., Rm. 233 Commercial Bank Bldg., Houston.

**Houston, Tex.*—The contract for erecting the Peden Iron & Steel Co.'s warehouse on Willow St. is reported to have been awarded to H. N. Jones for about $40,000.

Houston, Tex.—Bids are wanted July 25 for the erection of a 5-story steel office building for the Houston Land & Trust Co. Architects, Sanguinet & Staats, First Natl. Bank Bldg.

**Norfolk, Va.*—J. H. Pierce is stated to have received the contract for erecting a 6-story building here for W. N. Portlock.

Burlington, Vt.—W. R. B. Wilcox, 135 College St., it is reported, has completed plans for a $70,000 club house to be erected by the Algonquin and Ethan Allen Club.

**Walla Walla, Wash.*—J. L. Jones and Walter Bros. are stated to have received the contract for erecting a temple for the Masons of Walla Walla; probable cost, $30,000.

*The contract for erecting a brick theater at 4th Ave. and Alder St. is stated to have been awarded to J. H. Randall, of Seattle, for $28,700.

Seattle, Wash.—Saunders & Lawton, New York Blk., are stated to have been selected to prepare plans for a building to be erected on site of the building recently destroyed for Schwabacher Bros. & Co., Inc.

Spokane, Wash.—C. C. Dempsey is stated to have decided to erect a 3-story, 50x90-ft. business building at Front Ave. and Division St., at a cost of $30,000.

Fairmount, W. Va.—The Fairmont Lodge No. 9, A. F. & A. M., is reported to have purchased a site on Jefferson St., for the erection of a temple to cost $50,000.

Winton, W. Va.—It is stated that bids are wanted until July 20 for erecting a 5-story hotel here; H. W. Ewart, Secy.

Milwaukee, Wis.—A permit is stated to have been issued to John and Andrew M. Joys for the erection of a 6-story store building on E. Water and Market Sts., to cost $80,000. C. H. Crane, Archt.

NEW YORK, N. Y.

166 Cherry St., 6-story br. and stone store and tenement; c, $40,000; o, Chas. Peterson; a, Horenburger & Straub.

174 Hester St., 6-story br. and stone store and tenement; c, $20,000; o, Frank Pettilli; a, Richard R. Davis..

31 Pine St., 4-story br. and stone banking house; c, $150,000; o, W. S. Redmond & Co.; a, Bruce, Price & De Sebour and John Russell Pope.

Trinity Pl. and Rector St., 23-story br. and stone office bldg.; c, $1,600,000; o, United States Express Realty Co.; a, Clinton & Russell.

374 Water St., 5-story br. and stone stable building; c, $20,000; o, Matthew J. Sullivan; a, Thos. H. Boyce.

632 E. 11th St., 6-story br. and stone store and tenement; c, $45,000; o, Abraham Bernstein; a, Saml Sass.

29 W. 15th St., 10-story br. and stone loft bldg.; c, $100,000; O, Acme Bldg. Co.; a, W. G. Piqueron.

142 W. 29th St., 6-story br. and stone factory; c, $30,000; o, Robt. Christie & Son; a, Alfred H. Taylor.

220 E. 29th St., 2 6-story br. and stone stores and tenements; total c, $50,000; o, Louria, Genovese & Grassey; a, Horenburger & Straub.

9 W. 34tt St., 10-story br. and stone store building; c, $1,500,000; o, John Claflin; a, Hale & Rogers.

62d St. and Ave. A., concrete and steel gas holder; c, $40,000; o, Standard Gas Light Co.; a, Bartlett, Hayward & Co.

335 E. 65th St., 6-story br. and stone stores and tenements; total c, $30,000; o, Louis A. Solomon; a, Horenburger & Straub.

101st St. and 1st Ave., 5-story br. and stone stable; c, $35,000; o, David Dreyfuss and Chas. Mohr; a, Jas. J. F. Garigan.

247 E. 105th St., 2 6-story br. and stone stores and tenements; c, $80,000; o, Schesinger & N. Fenichel; a, Edward A. Meyers.

Items marked thus give the names of parties awarded contracts.

339 E. 113th St., 6-story br. and stone store and tenement; c, $30,000; o, Raphael Kurzrok; a, Horenburger & Straub.

70th and Exterior Sts., 2-story br. and stone loft bldg.; c, $29,000; o, Emma Lowe; a, A. C. Koenig.

127th St. and 3d Ave., 2 6-story br. and stone stores and tenements; total c, $60,000; o, S. Michaelson; a, B. W. Levintan.

133d St., and 5th Ave., 2 6-story br. and stone stores and tenements; total c, $90,000; o, Maisel & Rohman; a, Saml. Sass.

Prospect Ave. and Dawson St., 5-story br. tenement; c, $25,000; o, Anna Lendes; a, Vincent Bonagur.

Westchester and Brook Ave., 8-story concrete warehouse; c, $300,000; o, J. T. Finn; a, E. L. Phillips.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—Plans have been received for the R. C. Cathedral which is to be erected at a cost of $200,000. Dennis Murto, Treas. Bldg. Com.

New Britain, Conn.—W. H. Cadwell, of New Britain, has prepared plans for a chapel for the First Congregation Church, to cost about $15,000.

Chicago, Ill.—August Wallentin, of St. Paul, Minn., is stated to have purchased a site 100x200 ft., at Drexel Boule. and 49th St., on which to erect a 3-story brick apartment, to cost about $90,000.

The congregation of the Norwegian Lutheran Bethel Church, Rev. Carl E. Tiller, Pastor, is reported to have in contemplation the erection of an edifice at Humboldt Boule. and Shakespeare St., on a site 55x154 ft.; probable cost, $35,000.

S. Milton Eichberg and David S. Klafter are reported to be the architects for a monumental synagogue which is to be built on Marshfield Ave., near W. Polk St., for the Agudat Achem Jewish Congregation. It will be a 3-story, pressed brick and stone structure, 62x100 ft., and cost $50,000.

**Ruston, Ind.*—It is reported that Coates & Robinson, of Columbus, have secured the contract to erect an edifice for the United Presbyterian Church at a cost of $25,000.

Tulsa, Ind. Ter.—It is reported that the members of the M. E. Church are contemplating the erection of a $20,000 edifice. Address pastor.

**Clinton, Ia.*—N. C. Bacheller, of La Crosse, Wis., it is stated, has secured the contract to erect a R. C. Church here at a cost of $50,000.

Houghton, Mich.—It is reported that the Trus. of the Trinity Episcopal Church have decided to erect an edifice at a cost of $20,000. Address Rector.

Grand Rapids, Mich.—The plans prepared by H. J. Hill, of Detroit, for the St. Alphonsus R. C. Church, which is to be erected at Carrier St., near Lafayette Ave., have been accepted. The edifice is to be of brick and is estimated to cost $50,000.

**Perham, Minn.*—Kropp & Co., of St. Cloud, Minn., it is stated, have secured the contract to erect a R. C. Church here at a cost of about $35,000.

Minneapolis, Minn.—C. F. Sawyer will erect a 3-story flat at 1207-9 W. 25th St., to cost $20,000.

Wm. M. Kenyon, Guaranty Bldg., has prepared plans for a 3-story brick and stone residence, to be erected at Summit and Colfax Aves., at a cost of $30,000.

**Omaha, Neb.*—Walter Petersen, 14 U. S. Bank Bldg., it is stated, has secured the contract to erect a residence for J. A. Hornbach, the cost to be about $30,000.

Plans are being prepared for an edifice for the St. Bridget's R. C. Church, which is to be erected at 26th and F Sts., at a cost of about $30,000. Morgan Heafey is a member of the Bldg. Com.

Asheville, N. C.—The congregation of St. Lawrence R. C. Church, it is stated, has accepted plans and intends erecting an edifice at a cost of $50,000.

Columbus, O.—Bids will be received until July 27 by Rev. Wm. McDermott, 2351 N. High St., for the stone and brick church and school building and residence to be erected at E. Patterson Ave. for the Holy Name Parish.

Cincinnati, O.—Rapp, Zettel & Rapp, Johnston Bldg., it is stated, are preparing plans for a 4-story flat to be erected by Otto Betz on Erie Ave. and Edward St. at a cost of $30,000.

**Ashtabula, O.*—Andrews Bros., of Cleveland, it is stated, have received the general contract for the brick and stone St. Joseph R. C. Church, which is to be erected here at a cost of about $35,000.

Cincinnati, O.—See "Schools."

Cleveland, O.—The B'nai Jeshurun Congregation at Willson and Scovill Aves., it is stated, intends erecting a new synagogue at a cost of $40,000.

Oklahoma, Okla. Ter.—The members of the M. E. Church, it is reported, have decided to erect a $25,000 edifice. Address Pastor.

Pittsburg, Pa.—Certain architects have been requested to submit plans for the synagogue which is to be erected by the Dodeph Shalom Congregation at 5th Ave. and Bidwell St., the cost of the building alone not to exceed $150,000. Marcus Aaron is Chmn. of the Com. having in charge the acceptance of the plans.

Mitchell, S. D.—The members of the Methodist Church, it is reported, are contemplating the erection of a new edifice at a cost of $25,000.

Nashville, Tenn.—It is reported that the McKendree Methodist Church has been destroyed by fire.

Sherman, Tex.—Plans have been completed, according to reports, for a $20,000 R. C. Church, which is to be erected here. Rev. Jas. Blam, pastor.

**Appleton, Wis.*—The Geo. L. Smith Co., of Kaukauna, Wis., it is stated, has secured the contract to erect the Grace Episcopal Church at a cost of $25,000.

New York, N. Y.

135th St. and Riverside Drive, 6-story br. and stone tenement; c, $110,000; o, John V. Signell Co.; a, Neville & Bagge.

138th St. and Amsterdam Ave., 6-story br. and stone tenement; c, $48,000; o, Marks & Zeeman; a, Saml. Sass.

139th St. and Amsterdam Ave., 5-story br. and stone tenement; c, $48,000; o, Mark & Zeeman; a, Saml. Sass.

152d St. and Bway, 2 5-story br. and stone tenements; total c, $100,000; o, Geo. Schumar & Kaufman; a, Geo. F. Pelham.

163d St. and Amsterdam Ave., 2 6-story br. and stone tenements; total c, $74,000; o, S. Wittner; a, Bernstein & Bernstein.

Brown Pl. and 137th St., 4 5-story br. tenements; total c, $170,000; o, Max Gold; a, Horenburger & Straub.

Fairmount Pl. and Clinton Ave., 3 4-story br. tenements; total c, $54,000; o, Eastern Crown Realty Co.

136th St. and Brown Pl., 5-story br. tenement; c, $30,000; o, Hartman Schmidt; a, Wm. H. Birkmire.

156th St. and Southern Boule., 5 5-story br. tenements; total c, $205,000; o, Gustave E. Banhahue; a, Harry T. Howell.

178th and Bryant Sts., 5-story br. tenement; c, $35,000; o, M. Bonagur; a, Vincent Bonagur.

Brook Ave. and 135th St., 5 6-story br. tenements; total c, $245,000; o, Grossman Bros. & Rosenbaum; a, Geo. F. Pelham.

SCHOOLS.

Notes Arranged Alphabetically by States.

Geneva, Ala.—Bids will be received until July 20 by the Council for erecting a 2-story brick school; J. F. Johnson, Town Clk.

**Los Angeles, Cal.*—J. F. Millspaugh, Secy. Bd. Trus., writes that the contract for ventilating and heating State Normal School (bids opened June 27) has been awarded to F. O. Engstrom Co., of Los Angeles, for $16,375.

Athens, Ga.—Bids will be received by the Bldg. Com. (R. E. Davison, Chmn., Woodville, Ga.) until Aug. 7 for erecting 2 buildings at the State Normal School at Athens.

Atlanta, Ga.—It is reported that the congregation of the Central Presbyterian Church intends erecting a Sunday School building at a cost of $30,000. Rev. Theron Rice, Pastor.

Chicago, Ill.—The Council School Com., it is reported, has voted to appropriate $1,750,000 for new

Bids will be received until July 21 by the Com. on Bldgs. & Grounds, Bd. of Educ., 730 Tribune Bldg., for masonry, cut stone, terra cotta, sheet metal, composition roofing, structural iron, iron stairs, concrete floors, ventilating, steam heating, plumbing, etc., in 65th St. and Homan Ave. school.

It is stated that a recitation hall and chapel is to be erected for the Univ. of Chicago on the Midway, at a cost of about $310,000.

**Indianapolis, Ind.*—The following are reported to be the bids received June 29 for erecting buildings at the new State Industrial School for Girls, which include 7 cottages, a schoolhouse, power plant, dairy barn, stable and ice plant: John B. Warren, $154,000 (awarded contract); W. P. Jungclaus, $177,500; W. E. Moore, $178,000; John H. Schumacher, $190,920, and Fred. C. Smock, have been rejected.

Bids received at same time for a heating plant for same $192,945.

**Jefferson, Ia.*—Trich & Rigister, of Waterloo, it is reported, have secured the contract to erect the high school at $20,000.

Des Moines, Ia.—School bonds amounting to $40,000 have been sold. It is stated that the proceeds are to be used to erect a school at 16th and Jefferson Sts., in W. Des Moines.

Dubuque, Ia.—The School Bd., it is reported,, is preparing to spend $120,000 in new school buildings.

Donaldsonville, La.—D. B. Showalter is Secy. of the Com. having in charge the erection of a high school, for which $25,000 bonds have been voted.

Hagerstown, Md.—The Washington County School Bd., it is stated, has adopted a resolution requesting the Co. Comrs. to appropriate $25,000 for the erection of a high school.

Westfield, Mass.—At the town meeting, held July 3, it was voted to erect an addition to the rear of the high school and appropriate $32,000 for the purpose.

**Agricultural College, Mich.*—A. M. Brown, Secy. Agricultural College, writes that the contract for erecting a brick dormitory (bids opened July 7) has been awarded to Chittenden & Skinner, of Lansing.

Detroit, Mich.—Malcomson & Higginbotham, Moffat Bldg., it is stated, have prepared plans for the J. M. B. School, which is to be erected at 30th and Herbert Sts., at a cost, including ventilating and heating, at about $50,000.

Crystal Falls, Mich.—It is reported that the School Bd. has accepted plans for a school which is to be erected at a cost of $35,000.

**Rushford, Minn.*—It is reported that G. H. Guiser, of Rushford, has received the contract to heat the school at $4,750.

Laurel, Miss.—The City Council has authorized the issue of $20,000 bonds to be used to erect a brick school.

**Kirksville, Mo.*—It is reported that Al. Holmes, of Kirksville, has received the contract to erect the Science Hall at the Normal at $57,900.

Newark, N. J.—On July 6 bids were again opened by the Schoolhouse Com. of the Bd. of Educ. for the masonry work on Avon Ave. School, the list of bids received being as follows: Jas. Connolly, $44,973; Isaac V. Guerin, $49,621; John Gunn, $47,249; Walter E. Isetts, $49,000, and William H. Connolly, $45,700.

**New York, N. Y.*—The following are the bids opened on July 5 by C. B. J. Snyder, Supt. School Bldgs., for installing ventilating and heating aparatus in School 40, Boro. of the Bronx: Walker & Chambers, $32,475; United Heating Co., $33,871; Rossman & Bracken Co., $32,700; William N. Tobin, $32,314; R. W. Hillman, $29,370 (awarded contract); E. Rutzler Co., $32,692; Frank Dobson, $31,330.

Bids will be received until July 24 by C. B. J. Snyder, Supt. School Bldgs., Dept. of Educ., for sanitary work and gas fitting in school No. 38; alterations and divisions to heating apparatus in schools Nos. 20, 111 and 124, Boro. Manhattan; alterations and repairs to school No. 79, Whitestone; installing ventilating and heating apparatus in school No. 4, Long Island City; heating repairs, etc., to schools Nos. 2, 33, 34, 46 and 47, all in the Boro. of Queens; sanitary work in school No. 33, Grant City, and installing ventilating and heating apparatus and electric equipment in school No. 33, Grant City, Boro. of Richmond.

**Long Island City, L. I., N. Y.*—Tolmie & Kerr, 245 W. 12th St., N. Y. City, has secured the contract for fire escapes and alterations in School 35, Boro. Queens (bids opened July 5) for $4,437.

**New Brighton, S. I., N. Y.*—Frank J. Fee, 411 W. 32d St., N. Y. City, has secured the contract for sanitary work and gasfitting of addition to School 18, Richmond Boro. (bids opened July 5) for $6,891.

Albany, N. Y.—The following are reported to be the bids received July 3 by the Bd. of Contract & Supply for erecting School No. 16: Entire work: William J. McCann, $31,900; Maurice Mead, $31,450; Albany Material & Constr. Co., $35,040; Peter Keeler Bldg. Co., $32,535; M. L. Ryder Bldg. Co., $29,833; Collins Bros., $31,920. The amount available for the entire work is $30,500.

Bids were also received on portions of the work, the lowest submitted being as follows: Mason work, Peter Keeler Bldg. Co., $17,090; carpenter work, Feeney & Sheehan, $7,029; mason and carpenter work, Peter Keeler Bldg. Co., $25,700; plumbing, John Doyle, $1,690; heating, E. P. Bates, $3580.

Batavia, N. Y.—Bids will be received until July 24 by F. Park Lewis, M. D., Pres. Bd. Trus., N. Y. State School for the Blind, Batavia, for addition to plumbing, new steel ceilings and changes to electric light wiring and fixtures at the school.

Spencer, N. C.—See "Power Plants, Gas and Electricity."

Cincinnati, O.—Bids will be received until July 24 by the Bldg. Com. (J. M. Robinson, Chmn.), for cut stone work, concrete and cement work, and parking for the Central Fairmont School.

Bids will be received until July 24 by the Heating Com. (Geo. Friedlein, Chmn.), for installing a direct steam heating system in school at Harvey and Union Sts.

*The Bldg. Com. of the Bd. of Educ., it is stated, has awarded contracts for the Lick Run School as follows: Excavation and limestone masonry, Edw. Meyer, $66,946; roofing and metal work, Witt & Brown, $7,393; plumbing and gas fitting, Thos. Canary, $8,899; heating and ventilating, the Peck-Hammond Co., $18,459. The cut stone and concrete work are to be readvertised.

A building permit has been granted to the St. Patrick Congregation to erect a parochial school on Cherry St., at $18,000, and a parsonage on Blue Rock St., at $12,000.

It is reported that plans have been completed for erecting a $150,000 school at Fairmont Ave. and White St.

**Steubenville, O.*—Frank McFeeley, of Steubenville, it is stated, has received the contract to erect the high school, not including ventilating and heating, at about $81,800.

**Salem, O.*—John Kipp is reported to have secured the contract for erecting the Grove Ave. school for $31,395.

Cleveland, O.—Bids will be received until July 31 by the Bd. Educ., for erecting a manual training annex to the Quincy School, work to include masonry, carpentry, roofing and sheet metal, plumbing, heating and ventilating, etc. Bids on labor and material to be submitted separately. Chas. Orr, Dir. of Schools.

It is stated that a school is to be erected for the parish of Our Lady of Lourdes on Randolph and Hamm Sts., to cost $55,000.

It is stated that a 12-room addition is to be erected at the Marion School this fall.

Monclova, O.—Bids will be received until July 21 by the Bd. Educ., Monclova Township (Don. C. Whitehead, Clk.) for erecting 2 schools in said township.

Portland, Ore.—A high school to cost about $100,000 will probably be constructed this fall. Henry Allen, Clk. School Bd.

Reading, Pa.—It is reported that a parochial school is to be erected by the members of the St. Joseph Church at a cost of $25,000.

Jeannette, Pa.—Bids will be received until July 19 by Wm. C. Carle, Secy. Boro. School Bd., for installing a steam heating system in the West Jeannette school.

**Philadelphia, Pa.*—The Bd. of Educ.'s Com. on Property, it is stated, has awarded the contracts for erecting 2 wing addition to the Saml. B. Huey School at 52d and Pine Sts., to Henderson Bros., S. 25th and Spruce Sts., at $17,247, and to W. J. Smith, 1823 S. 5th St., the contract to erect a 2-wing addition to the Edw. T. Steele School, at 16th and Cayuga Sts., at $18,359.

**West Chester, Pa.*—Wm. H. Burns, of West Chester, it is stated, has secured the contract to erect the high school at a cost of about $75,000.

Red Lion, Pa.—The School Bd. is reported to have decided to erect a $25,000 school.

Wilkinsburg, Pa.—The School Bd., it is reported, has accepted plans for a $50,000 school to be erected in the 3d Ward.

Spencer, S. C.—Hook & Rogers, of Spencer, it is stated, have been engaged to prepare plans for a graded school to contain 10 rooms and auditorium and superintendent's office.

Dallas, Tex.—It is reported that the erection of a high school at a cost of $150,000 is under consideration.

Norfolk, Va.—It is stated that the Xavier Bros. intend erecting a college building at Old Point Comfort, Va., to cost about $130,000, and are now having plans prepared for same.

**Green Bay, Wis.*—August Nitz, of Green Bay, it is reported, has secured the general contract for the erection of the addition to the High School at $15,466.

**Winnipeg, Man.*—Geo. A. Mitchell, of Winnipeg, it is reported, has received the contract to erect a dairy and science building, power house, and principal's residence in connection with the Agricultural College, the total cost to be about $56,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Chicago, Ill.—The Finance Com. of City Council is reported to have rejected the two bids opened June 22 by the Comrs. of Pub. Wks. for the collection and disposal of garbage and refuse, and new bids will be received.

**Items marked thus give the names of parties awarded contracts.*

Marion, Ind.—Bids including plans and specifications will be received until July 25 by the Bd. Pub. Wks. (John O. Willson, Clk.) for the collection and reduction for a period of 10 or more years all garbage and dead animals within said city by the erection of a garbage reduction plant to be operated in a sanitary manner, as advertised in The Engineering Record.

Hoboken, N. J.—It is stated that bids will be received until July 26 by the Mayor and Council for the removal of ashes and garbage, rubbish, street sweepings, etc., for 1 year beginning Aug. 25. Jas. H. Londrigan, City Clk.

New York, N. Y.—Bids will be received until July 21 by J. McG. Woodbury, Comr. of St. Cleaning, for furnishing 7 sweeping machines for the Boroughs of Manhattan and Bronx, and 5 sweeping machines for the Boro. of Brooklyn; also for furnishing material and removing snow and ice in the Boro. of Manhattan.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Valley Falls Mfg. Co., Spartanburg, S. C., will add 4,000 spindles and 100 looms to its present plant.

The Ensign Foundry Co., Toledo, O., will add to its present factory a 60x128-ft. foundry and a 40x126 pattern shop, both buildings to be constructed of brick.

American Mfg. Co., Washington, D. C., will establish in Chattanooga, Tenn., or vicinity, a factory for the manufacture of automobiles, and will shortly be in the market for necessary equipment for this plant.

The Iola (Kan.) Milling & Elevator Co. will shortly begin the erection of a 45x60-ft., 4-story mill, with a capacity of 150 bbl. flour, 200 bbl. meal, and 4 to 6 cars of feed daily; 125-hp. engine and boiler outfit will be required.

Union Ice & Salt Co., Hutchinson, Kan., will rebuild its plant recently destroyed by fire.

Middletown (Pa.) Car Works is erecting a 70x250-ft. brick addition to its plant, which will provide for the installation of wood-working machinery and afford increased room and facilities for its steel car dept.

The Easy Washing Machine Co., St. Mary's, O., will erect an iron and concrete 2-story factory building, measuring 150x50 ft. A power plant of 75 to 100 hp. for gas or steam operation will be installed.

The Cantonement Plaster Co., Bickford, Okla., will erect a plant consisting of the following: Warehouse, 43x100 ft.; main building, 40x64 ft.; engine and boiler room, 50x40 ft.; dirt shed, 40x80 ft. This company is in the market for burr mills, belting, shafting, conveyors, etc.

Mr. Herman John, Dallas, Tex., will shortly erect a plant for the manufacture of fuel from lignite.

Axelson Machine Co., Los Angeles, Cal., is erecting a 43x155 2-story addition to its present plant.

German-American Button Co., Rochester, N. Y., will erect two factory buildings, measuring 50x300 ft. and 50x330 ft. respectively. In addition to these there will be two smaller buildings, one of which will be used as a storage warehouse. This company will also erect a power plant having a capacity of 600 hp.

Geo. A. Ohl Co., Newark, N. J., will shortly begin the erection of brick and steel addition to present plant measuring 56x235 ft. and to cost $20,000, according to local newspaper reports.

Arthur Hardwood Flooring Co., Memphis, Tenn., will shortly erect a large plant, according to local newspaper reports.

Union Cotton Mill Co., Memphis, Tenn., contemplates the erection of an extensive cotton mill and bag factory, according to local newspaper reports.

American Fork & Hoe Co., Memphis, Tenn., will shortly begin the erection of an extensive plant, according to local newspaper reports.

The Dayton (O.) Malleable Iron Co. will replace portion of its plant, recently destroyed by fire, by a 300x50-ft. brick and steel foundry building, and a 3-story, concrete, brick and steel structure for core making and storage.

A. J. West Lumber Co., Aberdeen, Wash., will erect a large saw mill plant, with planing mill, kilns, etc., having a capacity of 150,000 ft. per day.

Chas. Millar & Son Co., Utica, N. Y., will built a 40x110-ft., 5-story addition to its plant. Electric power will be used.

The N. K. Fairbank Co., Chicago, Ill., is preparing plans for a 200x124-ft., 4-story addition to its soap works, to cost about $150,000, according to local newspaper reports.

S. Karpen & Bro., Chicago, Ill., will erect two 1-story factory buildings, 160x40 ft. and 18x105 ft., respectively, at a cost of $50,000, according to local newspapers reports.

Puget Sound Metal Works, Tacoma, Wash., will erect a new plant, according to local newspaper reports.

The Hamilton Emery & Corundum Co., Chester, Mass., is building a 2-story, 30x60-ft. addition to its mill. The new building will be used for storage and additional machinery which will increase the plant's capacity about 30 per cent.

Mr. J. S. Walker, Ironton, O., is interested in the erection of a band mill in Mingo Co., W. Va., to have a capacity of 40,000 ft. per day, and is in the market for railroad and logging equipment.

Dr. D. G. Peyton, Jeffersonville, Ind., will shortly be in the market for an equipment of crushers, etc., for mining, crushing, bolting and barreling flour-spar on an extensive scale.

The Allentown (Pa.) Flint Bottle Co. will rebuild its plant, recently destroyed by fire. The new plant will consist of main building, 60x80 ft.; lehr building, 60x30 ft.; packing house, 22x56 ft.; box shop, 20x36 ft.; blacksmith shop and engine room, 20x40 ft.; boiler room and gas house, 40x40 ft.; batch house, 40x50 ft. The company will install 30-h.-p. boiler and 20-h.-p. engine; also dynamo, lights and equipment for electric lighting plant.

The John B. Stetson Co., Philadelphia, Pa., will erect a 72x152-ft., 8-story addition to its plant, according to local newspaper reports. The new addition will be of slow-burning mill construction and will cost about $125,000.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Maj. M. E. Craighill, Corps Engrs., U. S. A., writes that the Rudolph S. Blome Co., of Chicago, Ill., submitted the following bid on July 3 for building dam, abutment and guard cribs at Lock No. 1, McGrews Shoals, Tombigbee River, Ala.: 3 acres grubbing and cleaning, $40; 46,000 cu. yds. common excav., 95 cts.; 2,600 cu. yds. rock excav., $3; 1,600 cu. yds. stone fill, $3.25; 7,600 cu. yds. concrete (without cement), $4.86; 4,000 cu. yds. riprap, hand placed, $3.25; 189 M. ft. framed timber, $48; 25 M. ft. framed timber, $60; 37 M. ft. sheathing, $37.50. total, $118,814.

Wilmington, Del.—The following are the bids opened on July 6 by Capt. C. A. F. Flagler, Corps Engrs., U. S. A., for dredging Mispillion River (price given per cu. yd.): Chas. P. Grim, Philadelphia, Pa., 11 cts.; Wilmington Dredging Co., Wilmington, 14.3 cts., and Houston-Rickards Dredging Co., Philadelphia, Pa., 14 cts.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—The only bid received and opened on July 5 by Maj. S. W. Roessler, Corps Engrs., U. S. A., War Dept., Washington, for furnishing and delivering 36-in. searchlight outfits, was submitted by the General Electric Light Co., of Schenectady, N. Y., at $5,800 each, including searchlight and its truck and gasoline engine, dynamo, switchboard and its truck.

Bids will be received until July 18 by the Bureau of Supplies and Accounts, Navy Dept., Washington, for furnishing at the Navy Yard, Pensacola, Fla., and the Naval Station, New Orleans, La., the following naval supplies: Creosoted ties, rails, spikes, flat and dump carts, forced draft blowers, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

Chicago, Ill.—The following are the bids opened on July 7 by the Comrs. of Pub. Wks. for constructing 8,218 lin. ft. 16 ft. brick tunnel in Lawrence Ave. (price given per lin. ft.) bidders of Chicago, unless otherwise mentioned: M. H. McGovern, $79.50; J. H. Louchheim, Philadelphia, Pa., $82.40; W. J. Healy, $83.81; Union Paving Co., $89.50; M. P. Bryne Construction Co., $92; Joseph Handreddy, $96; Great Lakes Dock & Dredge Co., $96.50; John P. Agnew, $98; Griffiths & McDermott, $101; Nash Bros., $102; John J. Gallery, $111.33; John Dowdle, $118, and McNichols Co., $120.

Jacksonville, Ill.—The Willow Creek Drainage District is reported to have in contemplation the construction of a drainage ditch to cost about $15,000.

Rensselaer, Ind.—Bids will be received until Aug. 4 by the Bd. Co. Comrs. for constructing Iroquois Ditch and its arms. The work includes 57,925 yd. of rock, 25,365 yd. of earth on rock and 856,000 yd. of all earth. Jas. N. Leatherman, Co. Aud.

New Albany, Ind.—The Imperial Mining Co. contemplates installing a wire rope tramway for transporting ores 3 miles to Ohio River. Prof. J. F. Elsom, of New Albany, may be consulted regarding the matter.

Rensselaer, Ind.—Bids will be received until July 21 by the Comrs. of Jasper and Newton Counties at the office of Jas. N. Leatherman, Auditor of Jasper County, at Rensselaer, for constructing 2 sections of Moffitt Ditch, consisting in all of about 382,496 cu. yds.

**New Orleans, La.*—The following are the bids opened on June 15 by Capt. J. F. McIndoe, Corps Engrs., U. S. A., for jetty work at Sabine Pass, Tex., to consist of placing riprap stone (price given per net ton): Chas. Clark & Co., Galveston, Tex., $2.29 (awarded contract); J. A. Bel, Lake Charles, La., $2.95; St. Marys Dredging & Improv. Co., Ltd., Berwick, La., $4.25, and McGee & Co., Kansas City, Mo., $2.80.

Bids will be received until Aug. 10 by Capt. J. F. McIndoe, Corps. Engrs., U. S. A., New Orleans, for constructing about 1,000,000 cu. yd. of new levee at Bougere, in the Lower Tensas Levee Dist., and also until Aug. 11 for constructing 432,000 cu. yd. of levee work in Pontchartrain Levee Dist., both advertised in The Engineering Record.

Bids will be received until July 29 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for grading and filling at the Naval Station, New Orleans. Funds available, $35,000.

**Baltimore, Md.*—Bids were opened on July 5 by Lieut. Col. R. L. Hoxie, Corps Engrs., U. S. A., for dredging rivers and harbors on east shore of Chesapeake Bay, Md. The Maryland Dredging & Constr. Co., 807 Fidelity Bldg., bid for the whole work, 397,333 cu. yds., 12 cts. per cu. yd. (awarded contract, for a total of $47,680); John L. Grim, of Philadelphia, Pa., bid on the whole work, at 12, 13, 14, 15, 18 and 19 cts. per cu. yd. in different rivers and harbors; Sandford & Brooks Co., Baltimore, bid only for 192,700 cu. yds., 11.4 cts., and the River & Harbor Improv. Co., Philadelphia, Pa., bid for different portions of the work 12.9 cts., 13.4 cts., 14 cts., 14.5 cts., 17.9 cts., and 18 cts.

Boston, Mass.—It is stated that bids will be received until July 27 by the Harbor and Land Comrs. (Woodward Emery, Chmn.) for constructing a new outlet for Herring River at Harwich, Mass. The work to be done is the construction of a channel and jetties to form a new outlet to Herring River and the building of a dam to close the present outlet.

Detroit, Mich.—Bids will be received until Aug. 14 by Maj. Lansing H. Leach, Corps Engrs., U. S. A., Detroit, for dredging at Saginaw and Schewaing Rivers, Mich., as advertised in The Engineering Record.

St. Louis, Mo.—The Missouri & Illinois Tunnel Co. has been incorporated with a capital of $100,000 to connect St. Louis, Mo., and East St. Louis by a tunnel under Mississippi River. John T. Taylor, Gen. Mgr. of the St. Louis & O'Fallon Ry. Co., of St. Louis, Mo., is one of the incorporators.

Glendive, Mont.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Glendive, on Aug. 21, for 600,000 lbs. of square steel bars for reinforcement of concrete, as advertised in The Engineering Record.

**New York, N. Y.*—The following are the bids opened on July 7 by the Dept. of Docks & Ferries for building new pier at foot of E. 138th St.: G. B. Spearn, 17 Battery Pl., $33,603 (awarded contract); B. Rolf, 39 Cortlandt St., $35,808; N. Y. State Constr. Co., 78 Broad St., $36,414, and Godwin Constr. Co., 60 Wall St., $38,092.

Bids will be received until July 20 by the Park Bd. (John J. Pallas, Pres.) for furnishing and delivering 2,000 cu. yds. trap rock and 3,500 cu. yds. screenings of trap rock, for parks, Boro. Bronx.

Bids will be received until July 25 by the Dept. Correction (Francis J. Lantry, Comr.) for furnishing materials, erecting and installing new laundry machinery, metal dry room, etc., in new laundry buildings, workhouse, Blackwell's Island, Boro. Manhattan.

Bids will be received until July 21 for furnishing materials and building a sea wall at the northerly end of North Brothers Island, East River, Boro. Bronx; also for furnishing, delivering and putting in place about 15,000 cu. yds. of cobble and about 20,000 cu. yds. riprap stone, Boro. Manhattan.

Bids will be received until July 20 by the Park Bd. (John J. Pallas, Pres.) for furnishing materials and labor for the completion of grading, walls, steps and copings, etc., around Baird Court, in the N. Y. Zoological Park, Bronx Park, City of New York.

Albany, N. Y.—The River Improvement Comn. is reported to have asked the State Engr. to investigate and report on the advisability of improving Raquette River. The Comn. is studying the question of water storage on the tributaries of the Hudson.

Buffalo, N. Y.—The following are reported to be the bids opened July 8 by Col. Henry M. Adams, Corps. Engrs., U. S. A., for the stone superstructure, sea-slope and stone riprap on South Harbor section of Buffalo breakwater: C. M. Handy, Cleveland, O., $93,160; Grattan Constr. Co., Buffalo, $98,560, and the Continental Eng. & Constr. Co., Buffalo, $110,455.

Bids will be received until Aug. 7 by H. M. Adams, Corps Engrs., U. S. A., for building a concrete superstructure at the Inner Beacon of Maumee Bay Straight Channel Ranges, Ohio.

Cincinnati, O.—Bids will be received until Aug. 2 by Bd. Pub. Service (Geo. F. Holmes, Clk.) for grading the site of the new City Hospital and for building reinforced concrete retaining walls, as advertised in The Engineering Record.

Wauseon, O.—John F. Hettinger, County Surveyor, writes that bids will be received on Aug. 8 for about 15 miles of dredge work.

Panama.—Bids will be received until Aug. 11 by the Isthmian Canal Comn. (D. W. Ross, Gen. Purchasing Officer), at Washington, D. C., for furnishing sheet copper, copper rivets, asphalt melting furnaces and steam roller.

Scranton, Pa.—The Scranton Driving & Field Assoc. will erect a grand stand, stalls, fencing, etc., a cost of $20,000. E. H. Davis, archt., Connell Bldg., Scranton.

Pittsburg, Pa.—The following are the bids opened on July 3 by Maj. Wm. L. Sibert, Corp Engrs., U. S. A., Pittsburg, for building 6 bear-trap gates in Ohio River, Pa., 2 each at Dam No. 3, Glenosborne; Dam No. 4, near Legionville, and Dam No. 5, near Freedom: (*a*) Penn Bridge Co., Beaver Falls; (*b*) The Ohio River Contract Co., Glen Osborne, Pa.; (*c*) Baker Contr. Co., Pittsburg; (*d*) The Dravo Contr. Co., Pittsburg:

2 Bear-Trap Gates at Dam No. 3.

	a	*b*
46 M. ft. oak timber	$90.00	$100.00
2,500 lbs. bronze	.90	.50
12,000 lbs. cast iron	.05½	.06½
3,000 lb. wrought iron, bolts, spikes, etc.	.06	.06½
83,000 lbs steel castings	.12½	.12
520,000 lbs. wrought steel	.08	.08
†Painting iron work of 2 gates	1,500.00	1,500.00
Total	$60,705	$59,885

2 Bear-Trap Gates at Dam No. 4.

	a	*c*
46 M. ft. oak timber	$95.00	$100.00
2,500 lbs. bronze	.90	.50
12,000 lbs. cast iron	.06	.06
3,000 lb. wrought iron, bolts, spikes, etc.	.06	.06½
83,000 lbs. steel castings	.12½	.10
520,000 lbs. wrought steel	.08	.08
†Painting iron work of 2 gates	1,500.00	1,500.00
Total	$60,995	$58,165

2 Bear-Trap Gates at Dam No. 5.

	a	*d*
46 M. ft. oak timber	$95.00	$100.00
2,500 lbs. bronze	.90	.60
12,000 lbs. cast iron	.06	.07
3,000 lb. wrought iron, bolts, spikes, etc.	.06	.06
83,000 lbs. steel castings	.12½	.10
520,000 lbs. wrought steel	.08	.08¼
†Painting iron work of 2 gates	1,500.00	1,500.00
Total	$60,995	$59,820

†Lump sum.

Reading, Pa.—The City Council is stated to have on July 5 passed an ordinance providing for an appropriation of $44,500, as a preliminary for the amount approximating $140,000 for the construction of a subway under the tracks of the Philadelphia & Reading Ry., on Spring and 6th Sts. Chas. C. Weltmer, City Clk.

Block Island, R. I.—The following are the bids opened on July 8 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., for jetty extension of Great Salt Pond Harbor, Block Island (price given per net ton): E. S. Beldon & Sons, Hartford, Conn., $1.23; Rockport Granite Co., Rockport, Mass., $1.53, and J. K. Sullivan, Newport, $1.90.

Bids were opened same time and place for dredging at Great Salt Pond Harbor about 120,000 cu. yds. (price given per cu. yd.): Chas. H. Cole, Fall River, Mass., 27 cts.; John P. Randerson, Albany, N. Y., 38 cts.; International Contr. Co., New York, N. Y., 35 cts., and J. S. Packard Dredging Co., Providence, R. I., 31 cts.

**Items marked thus give the names of parties awarded contracts.*

Norfolk, Va.—The following are the bids opened on July 3 by Capt. E. E. Winslow, Corps Engrs., U. S. A., for dredging in Norfolk Harbor, about 130,000 cu. yds. (price given per cu. yd.): Sanford & Brooks Co., Norfolk, 12.9 cts and 10 cts.; Coastwise Dredging Co., Norfolk, 8.9 cts. and 9.5 cts., and Norfolk Dredging Co., Norfolk, 8.3 cts and 8.89 cts.

Bids will be received until Aug. 11 by Capt. E. Eveleth Winslow, Corps. Engrs., U. S. A., for dredging Pagan River, Va.

Seattle, Wash.—Bids will be received until Aug. 3 by Maj. John Millis, Corps. Engrs., U. S. A., Seattle, for dredging Lake Washington Canal.

PROPOSALS OPEN

For Proposals see pages 56, 60, 61, 62 AND 63

WATER WORKS.

Bids Close.		See Eng. Record.
Jul. 18.	System, Wahpeton, N. D.	Jun. 17
Jul. 18.	Mains and reservoir, Havre, Mont. Adv. Jun. 24, Jul. 1.	Jun. 24
Jul. 18.	Hydrants, etc., Washington, D. C.	Jul. 1
Jul. 19.	Pumps and engines, Panama Adv. Jun. 24 to Jul. 15.	Jun. 24
Jul. 19.	Pumps, Brooklyn, N. Y.	Jul. 1
Jul. 19.	Reservoir, Rochester, N. Y. Adv. Jul. 8, 15.	Jul. 8
Jul. 19.	Mains, New York, N. Y.	Jul. 8
Jul. 19.	Pipe, etc., Long Island City, N. Y.	Jul. 8
Jul. 19.	Pump station, etc., Brooklyn, N. Y.	Jul. 15
Jul. 19.	Extending system, Lancaster, O.	Jul. 15
Jul. 20.	Ft. Pierre, S. D.	Jul. 1
Jul. 20.	Tunnel, Chicago, Ill.	Jul. 8
Jul. 22.	Water works, Turin, N. Y.	Jul. 15
Jul. 22.	Water wks., Winside, Neb.	Jul. 15
Jul. 25.	Pipe, Cleveland Hgts., O.	Jul. 1
Jul. 25.	Hydrants, etc., Washington, D. C.	Jul. 15
Jul. 28.	Valves, Cincinnati, O.	Jul. 8
Jul. 28.	Well, Chicago, Ill.	Jul. 15
Jul. 29.	Pumps, Brooklyn, N. Y.	Jun. 24
Jul. 29.	Tunnel, Chicago, Ill.	Jul. 15
Jul. 31.	Pump, etc., Elyria, O. Adv. Jul. 15.	Jul. 15
Jul. —.	Water wks., Morehead City, N. C.	Jun. 17
Aug. 1.	Charleston, N. H.	Jul. 8
Aug. 1.	Laying pipe, etc., Cincinnati, O. Adv. Jul. 8, 15.	Jul. 8
Aug. 1.	Improv. water works, Ashland, Pa.	Jul. 15
Aug. 5.	Mains, Norwood, O.	Jul. 15
Aug. 7.	Pumping plant, Winnipeg, Man. Adv. Jul. 8, 15.	Jul. 8
Aug. 7.	Filter plant, St. Cloud, Minn.	Jul. 15
Aug. 7.	Pipe, Homestead, Pa.	Jul. 15
Aug. 8.	Water works, Columbia, S. C. Adv. Jul. 1, 8.	Jul. 1
Aug. 11.	Laying pipe, Cincinnati, O.	Jul. 15
Aug. 12.	Water wks., Newark, O. Adv. Jul. 15,	Jul. 15
Aug. 17.	Irrigation, Yuma, Ariz. Adv. Jun. 17 to Jul. 15.	Jun. 17
Aug. 28.	Canal, etc., Montrose, Colo. Adv. Jul. 15	Jul. 15
Aug. 30.	Improv., Owensboro, Ky.	Jul. 15
Aug. —.	Water wks., Bolivar, Tenn.	Jul. 15
Aug. —.	Improv., Donalsonville, La.	Jul. 15
Sept. 5.	Dam, etc., Cody, Wyo. Adv. Jul. 15,	Jul. 15
Sept. 6.	Tunnel, etc., Cody, Wyo. Adv. Jul. 15	Jul. 15
——	Water wks., Utica, Miss.	Jul. 15

SEWERAGE AND SEWAGE DISPOSAL.

Jul. 18.	Wahpeton, N. D.	Jun. 17
Jul. 18.	Lebanon, O. Adv. Jul. 8, 15.	Jul. 8
Jul. 18.	Oeonto, Wis.	Jul. 15
Jul. 18.	Summit, N. J. Adv. Jul. 15	Jul. 15
Jul. 18.	Perry, Ia	Jul. 15
Jul. 19.	Brooklyn, N. Y.	Jul. 8
Jul. 19.	Beloit, Wis.	Jul. 8
Jul. 19.	Indianapolis, Ind.	Jul. 15
Jul. 20.	St. Paul, Minn.	Jul. 15
Jul. 21.	Utica, N. Y. Adv. Jun. 17 to Jul. 15.	Jun. 17
Jul. 21.	Mauston, Wis.	Jul. 15
Jul. 22.	Ogden, Utah	Jul. 1
Jul. 22.	Lexington, Ky	Jul. 15
Jul. 24.	Washington, D. C. Adv. Jul. 8, 15.	Jul. 8
Jul. 24.	Portsmouth O.	Jul. 15
Jul. 24.	Marietta, O.	Jul. 15
Jul. 24.	Cincinnati, O.	Jul. 15
Jul. 25.	Laurens, S. C. Adv. Jul. 1, 8.	Jul. 1
Jul. 25.	Tampa, Fla. Adv. Jul. 8.	Jul. 8
Jul. 25.	Columbus, O.	Jul. 15
Jul. 25.	Huntington, Ind.	Jul. 15
Jul. 27.	Cincinnati, O.	Jul. 15
Jul. 27.	Mansfield, O.	Jul. 15
Aug. 1.	Toronto, Ont	Jun. 17
Aug. 1.	Washington, D. C. Adv. Jul. 8, 15.	Jul. 8
Aug. 1.	Charleston, N. H.	Jul. 8
Aug. 1.	Anaconda, Mont.	Jul. 8
Aug. 1.	Lake Placid, N. Y.	Jul. 15
Aug. 2.	Pipestone, Minn.	Jul. 15
Aug. 5.	Alliance, O.	Jun. 24
Aug. 8.	West Point, N. Y. Adv. Jul. 15	Jul. 15
Aug. 11.	Cincinnati, O.	Jul. 15

BRIDGES.

Jul. 18.	Anderson, Ind.	Jul. 1
Jul. 18.	Marietta, O.	Jul. 1
Jul. 19.	Superstructure, Hartford, Conn. Adv. Jul. 8.	Jul. 8
Jul. 19.	Substructure, Hartford, Conn. Adv. Jul. 8.	Jul. 8
Jul. 20.	Oglethorpe, Ga.	Jul. 8
Jul. 20.	Charleston, W. Va. Adv. Jul. 8.	Jul. 8
Jul. 20.	Litchfield, Minn.	Jul. 8
Jul. 20.	Buffalo, N. Y.	Jul. 15
Jul. 24.	Bloomington, Neb.	Jul. 15
Jul. 26.	Perth Amboy, N. J. Adv. Jul. 15.	Jul. 15
Jul. 27.	Dayton, O.	Jul. 15
Jul. 27.	Mansfield, O.	Jul. 15
Jul. 28.	Whitehall, Mich.	Jul. 15
Jul. 29.	Cleveland, O.	Jul. 15
Jul. 29.	Denver, Col.	Jul. 15
Jul. 31.	Danville, Ind.	Jul. 15
Aug. 1.	Elmira, N. Y. Adv. Jul. 15	Jul. 15

PAVING AND ROADMAKING.

Jul. 18.	East St. Louis, Ill.	Jul. 8
Jul. 18.	Oneonta, N. Y. Adv. Jul. 8, 15.	Jul. 8
Jul. 18.	McKees Rocks, Pa.	Jul. 8
Jul. 18.	Allentown, Pa. Adv. Jul. 15	Jul. 15
Jul. 18.	Ingram, Pa.	Jul. 15
Jul. 18.	Waterbury, Conn.	Jul. 15
Jul. 18.	Morris, Conn.	Jul. 15
Jul. 18.	Butler, Pa	Jul. 15
Jul. 19.	Hartford, Conn. Adv. Jul. 8.	Jul. 8
Jul. 19.	Brooklyn, N. Y.	Jul. 8
Jul. 19.	Freeport, Ill. Adv. Jul. 15	Jul. 15
Jul. 20.	Washington, D. C. Adv. Jun. 24 to Jul. 15.	Jun. 24
Jul. 20.	Port Clinton, O.	Jul. 8
Jul. 20.	Columbus, Ind.	Jul. 15
Jul. 21.	Creston, Ia.	Jul. 8
Jul. 21.	Buffalo, N. Y.	Jul. 15
Jul. 22.	Des Moines, Ia.	Jul. 8
Jul. 22.	Des Moines, Ia.	Jul. 15
Jul. 22.	Indiana, Pa.	Jul. 15
Jul. 22.	Dorranceton, Pa.	Jul. 15
Jul. 22.	Orvil, N. J.	Jul. 15
Jul. 24.	Flemington, N. J. Adv. Jul. 1 to 15.	Jul. 1
Jul. 24.	Indianapolis, Ind.	Jul. 15
Jul. 24.	Southampton, Pa.	Jul. 15
Jul. 25.	Tampa, Fla.	Jul. 1
Jul. 25.	Wilmington, N. C.	Jul. 8
Jul. 25.	Tampa, Fla. Adv. Jul. 8, 15.	Jul. 8
Jul. 25.	Centreville, Md.	Jul. 15
Jul. 25.	Columbus, O.	Jul. 15
Jul. 25.	Cumberland, Md.	Jul. 15
Jul. 26.	Cincinnati, O.	Jul. 8
Jul. 26.	Hoboken, N. J.	Jul. 15
Jul. 27.	Xenia, O. Adv. Jun. 24 to Jul. 15.	Jun. 24
Jul. 27.	Ft. De Soto, Fla.	Jul. 8
Jul. 27.	Rhinelander, Wis.	Jul. 1
Jul. 27.	Cincinnati, O.	Jul. 8
Jul. 27.	Mansfield, O.	Jul. 15
Jul. 28.	Akron, O.	Jul. 15
Jul. 29.	New Orleans, La.	Jul. 8
Jul. 29.	Des Moines, Ia.	Jul. 15
Jul. 31.	Monticello, Ind.	Jul. 15
Jul. 31.	Danville, Ind.	Jul. 15
——	Osceola, Ia. Adv. Jun. 24, Jul. 1,	Jun. 24
Aug. 1.	Belvidere, Ill.	May 20
Aug. 1.	Elizabeth, N. J.	Jul. 15
Aug. 3.	Springfield, Mass.	Jul. 15
Aug. 4.	Washington, D. C., Adv. Jul. 15	Jul. 15
Aug. 5.	Panama	Jul. 8
Aug. 5.	Bricks, Panama	Jul. 15
Aug. 7.	Martinsville, Ind.	Jul. 15
Aug. 7.	Greensburg, Pa.	Jul. 15
Aug. 8.	Shreveport, La.	Jul. 1
Aug. 11.	Cincinnati, O.	Jul. 15

POWER, GAS AND ELECTRICITY.

Jul. 18.	Washington, D. C.	Jun. 24
Jul. 18.	Washington, D. C.	Jul. 1
Jul. 20.	Fayetteville, N. C.	Jul. 8
Jul. 21.	Kansas City, Mo.	Jul. 8
Jul. 21.	El. light fixtures, Scranton, Pa.	Jul. 15
Jul. 21.	Chicago, Ill.	Jul. 15
Jul. 24.	New York, N. Y.	Jul. 15
Jul. 25.	Washington, D. C.	Jul. 15
Jul. 25*	Greenwood, Wis.	Jul. 15
Jul. 26.	El. light fixtures, Ft. Stevens, Ore.	Jul. 15
Jul. 31.	Monroe, Ga.	Jul. 15
Jul. —.	Morehead City, N. C.	Jun. 17
Aug. 1.	Durant, Miss.	Jul. 15
Aug. 2.	Indianapolis, Ind.	Jul. 8
Aug. 10.	Bellefontaine, O.	Jul. 15
Aug. 15.	Campbellsville, Ky.	Jun. 24
Aug. 24.	Fort Wayne, Ind.	Jul. 8
Aug. —.	Bolivar, Tenn.	Jul. 15
Oct. 1.	Tacoma, Wash.	Jul. 8

BUILDINGS.

Jul. 18.	**Schools, Wahpeton, N. D.**	Jun. 17
Jul. 18.	Schools, Youngstown, O.	Jul. 1
Jul. 18.	Engine house, Chicago, Ill.	Jul. 15
Jul. 18.	Hospital, New York, N. Y.	Jul. 15
Jul. 19.	Schools, Lancaster, O.	Jul. 1
Jul. 19.	Htg. school, Jeannette, Pa.	Jul. 15
Jul. 20.	Custom House, San Francisco, Cal.	Jun. 3
Jul. 20.	Court house, Mangum, Okla. Ter.,	Jul. 1
Jul. 20.	Courthouse, Manhattan, Kan.	Jul. 1
Jul. 20.	School, Montpelier, O.	Jul. 8
Jul. 20.	Hotel, Hinton, W. Va.	Jul. 15
Jul. 20.	School, Geneva, Ala.	Jul. 15
Jul. 20.	Post bldgs., Wash., D. C.	Jul. 15
Jul. 20.	Pub.* bldg., Livingston, Tex.	Jul. 15
Jul. 20.	Bus. bldg., Livingstone, Tex.	Jul. 15
Jul. 21.	School plans, Concord, N. H.	Jul. 8
Jul. 21.	Schools, Monclova, O.	Jul. 15
Jul. 21.	Pub. bldgs., Ft. Revere, Mass.	Jul. 15
Jul. 21.	Schools, Chicago, Ill.	Jul. 15
Jul. 21.	Engine house, Portland, N. D.	Jul. 15
Jul. 22.	**Hospital, New Orleans, La.**	Jun. 17
Jul. 22.	Asylum bldg., Wernersville, Pa.	Jul. 15
Jul. 24.	**P. O. Bldg., Fargo, N. D.**	Jun. 17
Jul. 24.	School, Morning Sun, Ia.	Jul. 1
Jul. 24.	Court House, Washburn, N. D.	Jul. 8
Jul. 24.	Post bldgs., Ft. Mackenzie, Wyo. Adv. Jul. 8, 15.	Jul. 8
Jul. 24.	School, Cincinnati, O.	Jul. 15
Jul. 24.	Htg. school, Cincinnati, O.	Jul. 15
Jul. 24.	Plumb., etc., school, Batavia, N. Y.	Jul. 15
Jul. 24.	School, New York, N. Y.	Jul. 15
Jul 25.	P. O. Bldg., Muncie, Ind. Adv. Jun. 24 to Jul. 8.	Jun. 24
Jul. 25.	Fire station, Atlanta, Ga.	Jul. 15
Jul. 25.	Bus. bldg., Houston, Tex.	Jul. 15
Jul. 25.	Engine house,* New York, N. Y.	Jul. 15
Jul. 26.	P. O. Bldg., Spartansburg, S. C. Adv. Jun. 24, Jul. 1.	Jun. 24
Jul. 26.	Fire hdqrs., Rochester, N. Y.	Jul. 15
Jul. 26.	I. O. O. F. bldg., Springfield, Mass.	Jul. 15
Jul. 26.	Engine house, Newark, N. J.	Jul. 15
Jul. 26.	Hospital, Lexington, Ky.	Jul. 15
Jul. 27.	Schools, Ft. Totten, N. D.	Jul. 1
Jul. 27.	Htg., etc., Post Office, Kansas City, Mo.	Jul. 8
Jul. 27.	Hospital addition, Ft. Casey, Wash.	Jul. 15
Jul. 27.	School, Columbus, O.	Jul. 15
Jul. 29.	Barracks, etc., West Point, N. Y. Adv. Jul. 1 to 15.	Jul. 1
Jul. 29.	Library, Cleveland, O.	Jul. 8
Jul. 29.	Stone work for Pub. Bldg., Wash., D. C. Adv. Jul. 15.	Jul. 15
Jul. 29.	Jail, Newport, Ark. Adv. Jul. 15.	Jul. 15
Jul. 30.	Court House improv., Leesville, La. Adv. Jul. 8.	May 13
Jul. 31.	Lighthouse bldgs., Detroit, Mich. Adv. Jul. 1 to 15.	Jul. 1
Jul. 31.	Vent. and htg. schools, Cleveland, O.	Jul. 8
Jul. 31.	Supreme Court Bldg., Jefferson City, Mo. Adv. Jul. 15.	Jul. 15
Jul. 31.	School annex, Cleveland, O.	Jul. 15
Aug. 1.	Power house, Wash., D. C.	Jul. 15
Aug. 1.	**Y. M. C. A. Bldg., Spokane, Wash.**	**Apr. 29**
Aug. 1.	Library, Louisville, Ky.	Jul. 1
Aug. 1.	School, Port Arthur, Tex.	Jul. 8
Aug. 1.	Lighthouse bldgs., Mobile, Ala.	Jul. 8
Aug. 1.	School, Washington, D. C.	Jul. 8
Aug. 1.	Capitol, Frankfort, Ky. Adv. Jul. 15.	Jul. 15
Aug. 1.	Hospital, Higginsville, Mo.	Jul. 15
Aug. 3.	Post bldgs., Cascade Locks, Ore.	Jul. 15
Aug. 3.	Quarters, Portland, Ore.	Jul. 15
Aug. 5.	Pub. bldg., Bremerton, Wash.	Jul. 1
Aug. 5.	Pub. bldg., Hot Springs, S. D.	Jul. 15
Aug. 5.	Infirmary, Carthage, O.	Jul. 15
Aug. 7.	P. O. Bldg., Adrian, Mich. Adv. Jul. 1, 8.	Jul. 1
Aug. 7.	Infirmary, Latonia, Ky.	Jul. 15
Aug. 7.	Post-Office improv., Calgary, Alta.	Jul. 15
Aug. 7.	Hospital, Rome, N. Y. Adv. Jul. 15,	Jul. 15
Aug. 7.	Pub. bldg. supplies, Panama	Jul. 15
Aug. 7.	School, Athens, Ga.	Jul. 15
Aug. 9.	Pub. bldgs., Chicago, Ill.	Jun. 17
Aug. 9.	School library, Bloomington, Ind. Adv. Jul. 8.	Jul. 8
Aug. 10.	Jail, Salem, Va.	Jul. 15
Aug. 14.	Court House, Cedartown, Ga.	Jul. 8
Aug. 14.	U. S. Custom House, Baltimore, Md. Adv. Jul. 15.	Jul. 15
Aug. 16.	P. O., McKeesport, Pa.	Jul. 15
Aug. 17.	Lighthouse, Buffalo, N. Y.	Jul. 15
Aug. 17.	P. O. extension, Burlington, Ia.	Jul. 15
——	**Schools, North Providence, R. I.**	Jun. 17
——	School, Phoenix, Ariz.	Jun. 24
——	Remodeling Court House, Taylorville, Ky.	Jun. 24

MISCELLANEOUS.

Jul. 18.	Supplies, Washington, D. C.	Jun. 24
Jul. 18.	Supplies, Washington, D. C.	Jul. 1
Jul. 18.	Ties, etc., Washington, D. C.	Jul. 15
Jul. 20.	Dredging, Honolulu, H. I. Adv. Jun. 24 to Jul. 15.	Jun. 24
Jul. 20.	Rem. of wreck, Charleston, S. C. Adv. Jun. 24 to Jul. 15.	Jun. 24
Jul. 20.	Dredging, Norfolk, Va. Adv. Jul. 1, 15.	Jul. 1
Jul. 20.	Park wk. walls, etc., New York, N. Y.,	Jul. 15
Jul. 20.	Park work, trap rock, etc., New York, N. Y.	Jul. 15
Jul. 21.	Mchy. for lock, Pittsburg, Pa.	Jun. 24
Jul. 21.	Sweeping machines, New York, N. Y.,	Jul. 15
Jul. 21.	Sea wall, etc., New York, N. Y.	Jul. 15
Jul. 22.	Dredging, Boston, Mass.	Jul. 1
Jul. 24.	Destructor, Panama Adv. Jun. 24 to Jul. 8.	Jun. 24
Jul. 24.	Canal work, Portland, Ore.	Jul. 1
Jul. 24.	El. Rys., Panama	Jul. 8
Jul. 25.	Dredging, Chicago, Ill. Adv. Jul. 1 to 15.	Jul. 1
Jul. 25.	Supplies, Washington, D. C.	Jul. 15
Jul. 25.	Mchy. in laundry, New York, N. Y.	Jul. 15
Jul. 25.	Garb. disposal, Marion, Ind. Adv. Jul. 15.	Jul. 15
Jul. 25.	R. R. wk., St. John, N. B.	Jul. 15
Jul. 26.	Garb. disposal, Hoboken, N. J.	Jul. 15
Jul. 27.	Steel barges, Panama Adv. Jul. 1 to 15.	Jul. 1
Jul. 27.	Channel, etc., Boston, Mass.	Jul. 15
Jul. 29.	Dredging, etc., Bremerton, Wash.	Jun. 24
Jul. 29.	Supplies, Panama	Jul. 1
Jul. 29.	Filling, etc., New Orleans, La.	Jul. 15
Jul. 31.	R. R. work, Miami, Fla. Adv. Jun. 24 to Jul. 15.	Jun. 24
Jul. 31.	Air compressors, etc., Panama Adv. Jul. 1 to 15.	Jul. 1
Jul. 31.	Cement, Glendive, Mont. Adv. Jul. 1 to 15.	Jul. 1
Jul. 31.	Lock gates, Pittsburg, Pa. Adv. Jul. 8, 15.	Jul. 8
Jul. 31.	Supplies, Panama	Jul. 8
Aug. 1.	Supplies, Washington, D. C.	Jul. 8
Aug. 2.	Dredging, Savannah, Ga. Adv. Jul. 8, 15.	Jul. 8
Aug. 2.	Retaining walls, etc., Cincinnati, O. Adv. Jul. 15.	Jul. 15
Aug. 3.	Dredging, Seattle, Wash.	Jul. 15
Aug. 3.	Dredging, Cape Charles, Va. Adv. Jul. 8.	Jul. 8
Aug. 4.	Ditch, Rensselaer, Ind.	Jul. 15
Aug. 7.	Beacon superstructure, Buffalo, N. Y.,	Jul. 15
Aug. 8.	Dredge work, Wauseon, O.	Jul. 15
Aug. 9.	Dock, Chicago, Ill.	Jun. 17
Aug. 10.	Levee work, New Orleans, La. Adv. Jul. 15.	Jul. 15
Aug. 11.	Levee work, New Orleans, La. Adv. Jul. 15.	Jul. 15
Aug. 11.	Supplies, Panama	Jul. 15
Aug. 14.	Dredging, Detroit, Mich. Adv. Jul. 15.	Jul. 15
Aug. 17.	Dredging, Norfolk, Va.	Jul. 15
Aug. 21.	Steel bars, Glendive, Mont. Adv. Jul. 15.	Jul. 15
Aug. 26.	**Coal plant, Olongapo, P. I.**	**May 6**
Sep. 1.	**Steel and iron, Sydney, N. S. Wales.** **Adv. Apr. 8, 22; May 6, 20; Jun. 3, 17.** Adv. Jul. 1, 15.	**Apr. 8**
Nov. 1.	**R. R. work, Manila, P. I.**	**Jun. 17**
Apr. 2,	**'06. Harbor Work. Valparaiso, Chili,** Adv. Apr. 29 to Jul. 15.	**Apr. 29**
——	Dam, etc., Charlestown, W. Va. Adv. Jul. 8, 15.	Jul. 1

**Items marked thus give the names of parties awarded contracts.*